



European Marine Science Educators Association

Annual Conference

Hosted by The School of Natural and Environmental Sciences,
Newcastle University

2 - 5 October 2018

Great North Museum, Newcastle-Upon-Tyne

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Foreword



Dear Delegates

We are delighted to welcome each of you to the 6th European Marine Science Educators Association conference in Newcastle. It is an exciting time for EMSEA as we continue to grow and become more visible on the European and international scene.

EMSEA was founded on the vision that European marine education needed an effective transformation and stronger international connection in order for marine teachers and educators to feel more supported, engaged and equipped for the task to make European citizens more ocean literate. EMSEA is therefore dedicated to facilitate the exchange of success stories and good practise in marine education and to strengthen the links between marine education stakeholders (teachers, educators, project manager, scientists, marine enthusiasts etc.).

At Newcastle University, engagement is an integral part of our teaching, research and service endeavours. As a civic university, we are committed to delivering benefits to individuals, organisations and to society as a whole. This means putting academic knowledge, creativity and expertise to work, to develop innovations and solutions that make a difference regionally, nationally and internationally.

This conference will be an amazing opportunity for all of us to get inspired and to share our passion for marine education, but also to energise ourselves with new ideas and to meet old friends and make new contacts.

The 2018 conference program has been designed to give a mix of informative presentations and workshops to facilitate discussion on present and future developments of Ocean Literacy. In the spirit of engagement we hope this meeting in Newcastle provides you with the opportunity to meet colleagues from across the globe, to engage in exciting dialogue, and contribute your expertise. We look forward to a productive workshop and a bright future for new collaborations.

We would like to thank each of you for attending the conference and bringing your expertise. You, as a marine educator, marine scientist and marine education project leaders have the vision, the knowledge, the wherewithal and experience to help us pave our way into a more ocean literate future.

Kind Regards

Annie Russell, Chair of Organising Committee, Newcastle



Arches on the main campus, Newcastle University, Newcastle upon Tyne

Newcastle University, Marine Science Facilities



The Dove Marine Laboratory,
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Blyth Marine Station,
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RV, Princess Royal, Blyth, Northumberland

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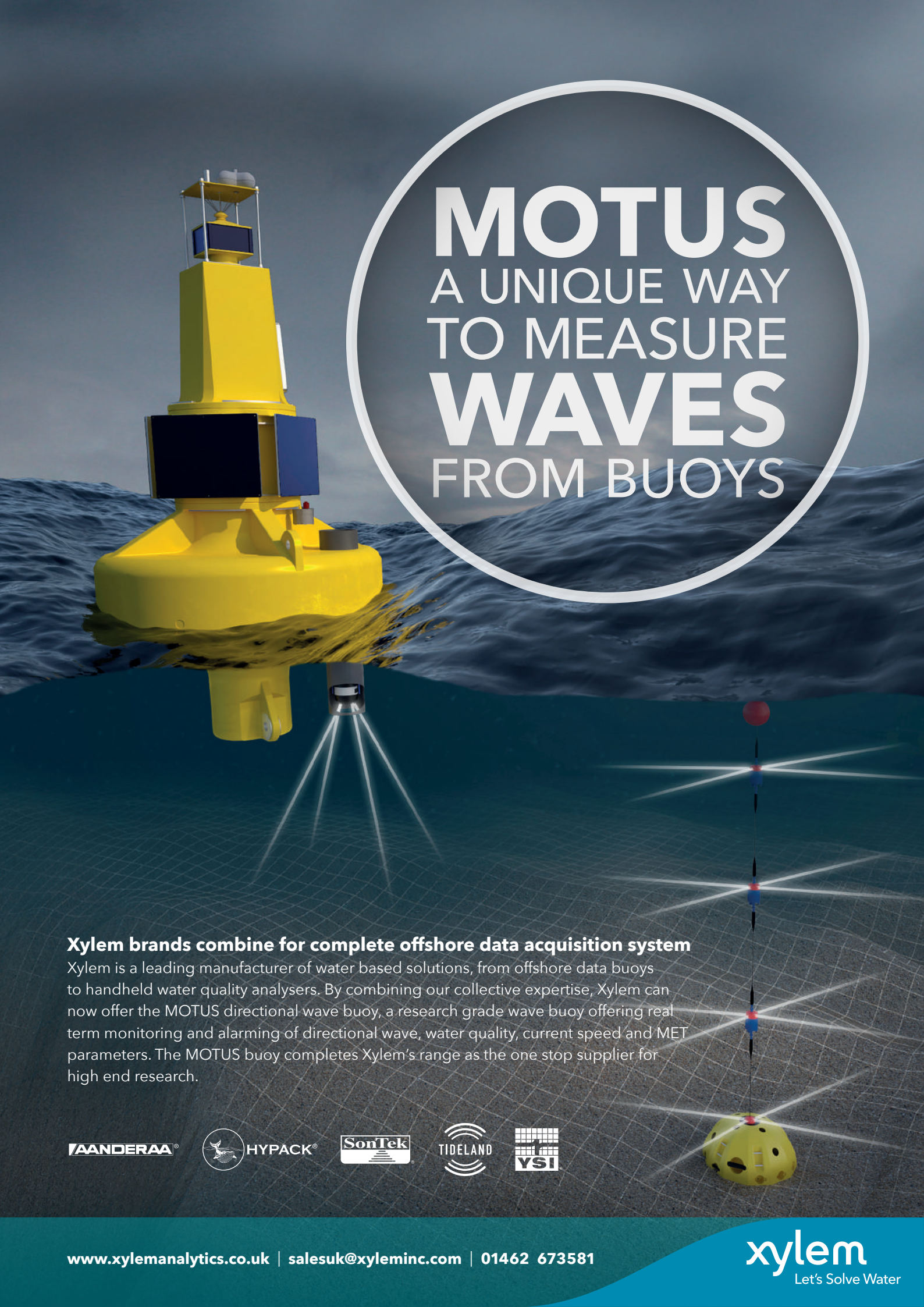
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LEARNING

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The NMA Learning programme is designed to connect us with the Ocean and promote Ocean Literacy.



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“In the end, we will conserve only what we love; we will love only what we understand and we will understand only what we are taught.”

- Baba Dioum

Each of us here at the EMSEA conference share a common objective - to increase ocean literacy levels in citizens across the globe. To achieve this, we need to engage, enthuse and educate people of all ages and from all walks of life.

At Blue Inspiration, engaging our audiences and fostering stewardship of our planet's life support system is not just our business - it's our passion!

We're helping to increase ocean literacy levels in our audiences across the UK, Ireland and beyond, by creating bespoke science communication products which incorporate stealth learning.

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Our dedicated team is comprised of:

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- **Software developers** - to translate our ideas into digital interactives
- **Graphic designers** - to bring the "Wow" factor to our concept designs

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Keynote Speaker: Dr Jonathan Copley



Dr Jon Copley: Associate Professor in Ocean Exploration & Public Engagement (part-time) within Ocean and Earth Science, National Oceanography Centre Southampton at the University of Southampton, where he has received awards for teaching and postgraduate skills training. His programme of public engagement with his research, which includes frequent work with the media, public talks, and online engagement, resulted in a 4-star REF 'Impact Case Study'. His awards as a science communicator include the Biosciences Federation Science Communication Award for Established Researchers, and he was also previously a Reporter and Assistant News Editor at New Scientist magazine.

His research explores colonies of animals on the ocean floor, to understand patterns of life in the deep sea that covers most of our world. By studying marine life in "island-like" habitats such as hydrothermal vents, his work examines interactions between ecology ("who does what"), biogeography ("who lives where"), and evolution ("who is related to whom") in the ocean depths.

Jon has more than twenty years of experience in exploring the deep ocean, including leading expeditions aboard research ships, using Human-Occupied Vehicles (HOVs) and Remotely Operated Vehicles (ROVs), and discovering new species of deep-sea animals.

In June 2013 Jon became the first British person to dive more than 5 km deep in the ocean, taking part in the first dive by a human-occupied vehicle to the world's deepest known hydrothermal vents. In December 2016 he also took part in the first dives by human-occupied vehicles to 1 km deep in the Antarctic, during filming of the BBC's Blue Planet 2 series.

As our everyday lives are connected to the deep ocean in ways we seldom realise, he works with documentary makers to share the exploration of the deep ocean with people worldwide, and routinely interact with news media to raise awareness of deep-sea issues and his team's discoveries.

Jon frequently talks about exploring the deep ocean to public audiences ranging from local school and community groups to major events and festivals, and have created online resources for people to join in our voyages. This overall programme of public engagement with ocean exploration resulted in a successful "Impact Case Study" for REF2014.

Staff Profile: <https://www.southampton.ac.uk/oes/about/staff/jtc.page>

Keynote Speaker: Stephen Hall



Stephen Hall, CEO, Society for Underwater Technology

Chief Executive at the Society for Underwater Technology www.sut.org, former Vice-Chair of Intergovernmental Oceanographic Commission & Co-chair of UNESCO-IOC working group on Areas Beyond National Jurisdiction (2015-17)

Interested in stewardship and governance of the global ocean, especially in areas beyond national jurisdiction; 'Blue Growth'; Marine Spatial Planning; Marine-related education and training; Capacity development; Use of Marine Autonomous Systems; Geohazard warning and monitoring; Deep-ocean resources; Sustainable aquaculture; Promotion of role of non-State sector (NGOs, industry, charities etc) in international marine science data acquisition and ocean monitoring.

Member of: UK Govt Ocean Processes Evidence Group (OPEG); Marine Science Coordination Committee Marine Industries Liaison Group (MSCC-MILG); Marine Climate Change Impacts Partnership Steering Group; IMarEST Operational Oceanography & marine renewables SIG & Science & Technology Advisory Group; Advisory Committee for Marine Alliance for Science & Technology for Scotland (MASTS); MSCC Underwater Sound Forum; European Marine Science Educators Association

Specialties: Informing policy with evidence, international cooperation, education, outreach, capacity-building, knowledge exchange, small island developing states, marine environment assessment, marine autonomous systems, subsea technology development, marine renewable energy, deep-sea mining, building links between industry and academia, law of the sea, new uses of the ocean, defence, volunteer networks, role of learned societies and professional bodies, stewardship

Profile: <https://uk.linkedin.com/in/stephen-hall-5b5404b>

Keynote Speaker: Prof. Alan Deidun



Prof. Alan Deidun, Associate Professor, Geosciences, University of Malta

Prof. Alan Deidun is Director of the International Ocean Institute - Malta Training Centre and a Fellow of the Royal Society of Biology (London). He is also an Associate Professor at the Physical Oceanography Research Group within the Department of Geosciences of the Faculty of Science of the University of Malta, being primarily trained and with experience as a coastal and marine biologist. He sits on the Board of the Environment and Resources Authority (ERA) of Malta. He holds a PhD in biology and has published over 100 peer-reviewed papers in several high-profile academic journals on various aspects of coastal and marine biology. He is currently lecturing within the Master of Science in Applied Oceanography, as well as in a number of other Masters courses at the University of Malta (including the Master in Ocean Governance). He is also currently supervising a number of student dissertations at Masters and PhD level and, since 2003, has contributed to numerous University taught and field courses. At the University of Malta, he has acted as Project Manager for the MED-JELLYRISK, SeaofSkills, PANACEA, BIODIVALUE and PERSEUS projects, and Coordinator of the Spot the Jellyfish and Spot the Alien Fish citizen science campaign.

He has coordinated the marine ecology section of numerous recent Environmental Baseline Study (EBS), Environmental Impact Assessment (EIA) and Appropriate Assessment (AA) studies. The main thematic areas which interest him are coastal (especially beach) and marine ecology, biological oceanography, ecological modelling, remote sensing monitoring of water quality, management and monitoring of marine living resources, ecology of islands, ecology of invasive species, Marine Protected Areas (MPA's), Marine Spatial Planning (MSP) and dynamics of jellyfish outbreaks.

He has also penned since 2001 hundreds of popular science articles for various media portals, including newspapers, magazines and journals and is Council member of the NGO Din l-Art Helwa. He is also a member of the Society of Biology of the UK the Societa di Biologia Marina of Italy. In 2011, 2012 and 2014, he was presented with the Environmental Journalism Award for Malta by the Institute of Maltese Journalism.

Staff Profile: <https://www.um.edu.mt/profile/alandeidun>

Keynote Speaker: Melissa Ryan



Melissa Ryan, Marine Educator, Global Foundation for Ocean Exploration

Melissa Ryan is a scientist, ocean explorer, and educator with more than 25 years of experience in the oceanographic and education fields. She has led twelve expeditions to search for the Bonhomme Richard, flagship of John Paul Jones. This includes liaising with the U.S. and French Navies to establish partnerships, directing at-sea operations, expedition planning and international and media relations.

She has an extensive background in education, having instructed online courses for undergraduates and teachers on science topics. She designed and instructed the US Naval Academy's only online course, History, Science, and Engineering. Melissa worked for seven years as an Education Specialist for NOAA's Office of Ocean Exploration and Research, where she managed a national professional development program on ocean science and exploration for educators.

Prior to her work in education, she spent ten years analyzing and promoting environmental policy for the Connecticut Council on Environmental Quality.

Her career highlights include spending five days on the U.S. Navy's Submarine NR1 in the North Sea, diving in the undersea canyons off the eastern U.S. in submersible systems such as the Johnson-Sea-Link and the Submarine Delta, and instructing Naval Academy midshipmen and other students on her expeditions.

Staff Profile: <http://www.engineeringfordiscovery.org/about/team/ryan-melissa/>

Keynote Speaker: Thomas Furey



Thomas Furey, Marine Institute, Ireland

Thomas Furey is the manager of Advanced Mapping Services at the Marine Institute. He is also the joint programme manager (with GSI) of INFOMAR, the national marine resource mapping programme. Tommy coordinates marine survey operations, and promote research development in the applied use of our seabed mapping data and technologies.

Key-note talk: Mapping the unknown: the hidden wonders of our ocean floor

Our vast global ocean floor to this day is largely unexplored, uncharted, and poorly understood. Representing more than 70% of our valued Earth's surface, why then is it mapped mostly at such poor resolution that we only have a single seabed depth measurement in every 5 x 5 km grid cell of this vast domain. The often-heard assertion that we know more about the surface of Mars than about our ocean seafloor clearly holds true. What animals, complex systems, and active volcanoes or hydrothermal vents exist on the ocean floor? Closer to our shores, shipwrecks, treasures and lost civilizations make us wonder how humanity has always been inextricably connected with the ocean, and yet we ignore its basic geography, composition, and life support function.

Workshops

Workshop 1:

Why do we need a map? Engaging educators with seabed mapping

(An open workshop, sponsored by the H2020 AORA-CSA project)

Facilitator: Ana Noronha, Ciência Viva and AORA-CSA

Short initial interventions: Thomas Furey (Marine Institute, Ireland), Patrícia Conceição (DGPM-Portuguese Ministry of the Sea, Portugal), Noirin Burke (Explorers Education Programme, Marine Institute, Ireland), Melissa Ryan (Global Foundation for Ocean Exploration, USA).

The main objective of this workshop is to gather educators and scientists to discuss the importance of seabed mapping and how to raise awareness about the need to map the ocean floor.

Most of the seabed is still uncharted or mapped with a very low resolution. And yet most people are not aware of the importance of having an accurate map and of studying the ecosystems lying at the bottom of the ocean.

Educating children and teenagers about abstract concepts is not an easy task. The participants of the workshop will have the opportunity to share resources and best practices on how to address seabed mapping in the classroom and in informal contexts.

Workshop 2:

Assessment of the Effectiveness of Ocean Literacy Initiatives

*Facilitator: Dr Owen Molloy, Conor McCrossan, National University of Ireland Galway
Matthew Ashley, Plymouth University*

It is widely accepted that Ocean Literacy (OL) is not just about knowledge, but our attitudes, our ability to understand complex issues and see alternatives, and how we communicate and act personally and within our communities. The various aspects of dimensions of OL (e.g. Awareness, Knowledge, Attitudes, Communication,..) are not entirely independent, but we can design instruments to monitor and measure them independently if desired.

This approach can give us a more fine-grained view of OL, and allows us to tailor campaigns or educational interventions targeted at specific dimensions for specific actors.

In this workshop we share our experiences in designing ocean literacy tools, and processes for measuring their effectiveness. We would like to give participants hands-on experience with the tools themselves, and also share their own experiences and opinions on how best to assess the effectiveness of ocean literacy tools and initiatives. We will look in particular at the application of a Theory of Change model in assessing the effectiveness of education and sustainability training courses for fishermen and shipping industry professionals.

ResponSEable is a European Union Horizon 2020 project focused on increasing ocean literacy. The project is working on media and outreach activities including films and film making competitions, an educational computer game and other learning materials, a social media campaign, and an interactive website. The project is focused on key ocean health issues and has created 6 ResponSEable Key Stories, namely eutrophication and agriculture, ballast water and invasive alien species, sustainable fisheries and aquaculture, microplastics and cosmetics, coastal tourism, and marine renewable energy (www.responseable.eu).

Workshop 3:

Potential scenarios for embedding Ocean Literacy in Higher Education

The recently published Marine Board Future Science brief on “Training the 21st Century Marine Professional” pointed out at several stages that Ocean Literacy may play an important role in future marine graduate training and education. In this workshop methods will be explored on how aspects of “Ocean Literacy” can be embedded in higher education programmes. After presentation of some examples and good practices from existing programmes, the workshop aims at exploring other methods and reviewing these using the SWOT methodology. Workshop attendees will as such explore different methodologies for embedding “Ocean Literacy” both vertically and horizontally in marine graduate training.

Key examples presented are based on preparatory work carried out for the future Science Brief making use of the Marine Training portal (www.marinetraining.eu) and examples taken from existing graduate programmes paying already attention to these elements.

Workshop 4:

WORKSHOP Aquabotz – Contagious, Experiential Learning by Building Inexpensive, Non-threatening, Underwater Robots

*Facilitators: Dr. Douglas R. Levin, Center for Environment & Society, Washington College
Mrs. Evy Copejans, VLIZ Flanders Marine Institute*

The shortage of youth in the professional pipeline for Marine Industries is blamed on a lack of experiential programs that launch contagious interest in the sciences. Ocean Exploration identifies education and outreach as critical to entice students into the field. Education works best when the lesson topic is invisible, the delivery contagious, and the end result addictive. Head into a classroom and announce that you're going to be lecturing about circuits and electricity. At any age, this might result in a "snore-fest". Change the preamble to "today we'll be building underwater robots" and you'll see the students lean forward... In this workshop participants are provided with components needed to build a working and tethered ROV. They will be taught how to deliver the "Aquabotz" program by being students.

"Aquabotz" was created in 2002 through a NASA/Academic partnership and grew through training with the Marine Advanced Technology Education Center (MATE) of Monterey Peninsula College. Student groups introduced to ROV's with this program have gone on to compete internationally in the MATE ROV competition. Over the years, the Aquabotz program has been delivered by Washington College from the 3rd grade (8-10 yrs) to adults. The Aquabotz can be designed, built and operated in about an hour. They are deployed off a dock or pool-side and can be tested, pulled out, dismantled, and modified to optimize the design. The challenge is to build a fully functional ROV capable of floating, sinking and moving into all directions. Aquabotz Kit – Parts are readily available from hardware or hobby stores, or the Internet. There is no need for soldering. Aquabotz have printed circuit boards and screw on wire connectors. PVC pipes are used for the frame and bilge pump motors for thrust. Speaker wire transfers the power and control information from switches in a control box to the ROV. Three thrusters allow for all directional movements. A rheostat allows for varied vertical control for diving, surfacing and water column hovering. Buoyancy uses foam pool noodle pieces fastened to the frame with reusable plastic cable ties. The PVC frame holds together with friction. There is no glue. Aquabotz are safely powered by a 12v battery backpack carried by the operator. In addition, an underwater video camera can be deployed on the ROV for observation. In an exemplary program students used nylon cloth to build Aquabotz with plankton catchers. Following deployment, the net contents were analyzed and sketched by the students.

Using ROV's as a platform for learning has many advantages. The Aquabotz program encourages interdisciplinary instruction. Their use supports the introduction of marine and non-marine related career paths. Subjects such as science, math, physics, technology, and art are delivered without students knowing it. Techniques for critical thinking, team building, sportsmanship, verbal and written communication skills are also delivered with this program. The program is hands-on and demonstrates value-added topics, such as, basic tool use, teamwork, electrical concepts, buoyancy, and propulsion.

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A Framework for the Assessment of the Effectiveness of Ocean Literacy Initiatives

Mr. Conor McCrossan¹, Dr. Owen Molloy¹

1. National University of Ireland Galway

- Mr Conor McCrossan, National University of Ireland Galway
- Dr Owen Molloy, National University of Ireland Galway

This research has been undertaken as part of the Horizon 2020 ResponSEable[1] project which focuses on increasing ocean literacy. The existing instruments for the measurement of Ocean Literacy (OL) contain questions and statements related to ocean literacy in general and a combination of a number of different ocean related topics. The OL dimensions we are using are awareness, knowledge, attitude, communication, behaviour, and activism. The purpose of our research is to design, implement, and validate a framework which focuses on topics related to the ocean and can be used to create instruments which measure the OL dimensions of the topics. The instruments created using our framework can be used to assess the effectiveness of OL tools and initiatives. Our framework uses a combination of the Ocean Literacy Principles[2] (OLP), the Environmental Literacy Ladder[3] (ELL), and the Driver-Activity-Pressure-State-Impact-Welfare-Response[4] (DAPSIWR) framework. The OLP is a set of 7 ocean literacy principles, the ELL outlines 5 essential steps/components of environmental literacy, and the DAPSIWR is an approach to modelling the interaction between humans and the environment. Our framework will be used to create measurement instruments to measure the effectiveness of the ResponSEable project's ocean literacy tools and initiatives. This research will be useful to people involved in the creation and deployment of ocean literacy initiatives because it provides them with a framework to assess the effectiveness of their initiatives. The software system associated with the framework provides tools to help the user to create the measurement items, receive the responses to the items, and analyse the resulting data.

The experiments performed to validate our framework will use instruments created using our framework. The instruments will be based on the: content of the OL tools and initiatives, and on which of the OL dimensions are most relevant to measure. The same questions can be asked of participants before and after they have used the OL tools, and questions can also be dispersed throughout the participant's interaction with the OL initiative. The types of OL initiatives developed as part of ResponSEable are: documentary films, educational packages, serious games, visualisations, and social media campaigns.

The analysis of the before and after questions will give a clear indication of how much the participant has moved on the OL dimension scale. Responses to questions dispersed throughout the OL initiative can be compared with existing data in the literature to check if the responses signal an improvement in OL dimensions. Questions on ocean related topics can be grouped into a questionnaire/survey and used to check if correlations exist between some of the OL dimensions defined in our framework. The correlations that exist between the OL dimensions of two different OL initiatives can be compared to give an indication of which OL initiative is more effective.

[1] <https://www.responseable.eu>

[2] <http://www.coexploration.org/oceanliteracy/documents/OceanLitChart.pdf>

[3] <http://www.fundee.org/facts/envlit/whatisenvlit.htm>

[4] <http://www.ejolt.org/2013/02/dpsir/>

A north-east England Case Study in Coastal Citizen Science

*Ms. Jade Chenery*¹, *Ms. Stephanie Dickens*¹, *Dr. Jane Delany*¹, *Dr. Heather Sugden*¹, *Dr. Stuart Jenkins*², *Dr. Siobhan Vye*², *Ms. Hannah Earp*², *Ms. Debbie Winton*³, *Dr. Sue Hull*⁴, *Dr. Nicky Dobson*⁴, *Dr. Nova Mieszkowska*⁵, *Ms. Leoni Adams*⁵, *Ms. Hannah Wilson*⁵, *Ms. Justine Millard*⁶, *Dr. Leonie Richardson*⁶, *Dr. Gordon Watson*⁷, *Ms. Zoe Morrall*⁷, *Ms. Sarah Long*⁷, *Prof. Michael Burrows*⁸, *Dr. Hannah Grist*⁸, *Mr. Peter Lamont*⁸

1. Newcastle University, 2. Bangor University, 3. Earthwatch Institute, 4. Hull University, 5. Marine Biological Association, 6. Marine Conservation Society, 7. University of Portsmouth, 8. Scottish Association for Marine Science

Capturing Our Coast (CoCoast) built on the success of a similar citizen science project, Big Sea Survey (BSS), in the north-east of England. With Newcastle University as the lead hub, CoCoast aims to explore the extent to which members of the public can contribute robust and meaningful data to underpin ecological science, policy and conservation measures. The CoCoast north-east team are based at the Dove Marine Laboratory in Cullercoats and are responsible for the area extending from the Scottish border at Berwick-upon-Tweed down to the River Tees, covering the coastlines of Northumberland and Durham. Here in the North East some of the BSS volunteers transitioned effortlessly into the CoCoast project, and during the three years of the project, ~360 regional citizen scientists have been trained to collect rocky shore data. The poster will present some of our survey and experimental findings, and discuss the successes we have had across the region with engaging people from all walks of life with the coastal environment.

A University – Municipality partnership: Marine Environmental Awareness training (k12) in Turkey

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1. Middle East Technical University-Institute of Marine Sciences, 2. Mersin Metropolitan Municipality Head of Environmental Department part, 3. I, 4. Middle East Technical University - Institute of Marine sciences, 5. M, 6. Mi

“I Know and Protect My Seas” (DTK) is a marine science outreach program which provides marine environmental awareness training to Turkish schoolchildren mainly 5th- 7th grades (11-13 yr olds). The programme, predominantly aimed at instilling awareness of the negative impacts of marine litter, threats to endangered marine species and the importance of biodiversity, ongoing since 2012, is run by the Institute of Marine Sciences (IMS) of the Middle East Technical University (METU) in Mersin, southern Turkey. The IMS campus location is of significant ecological importance since its unofficially protected turtle nesting beach (located on a stretch of vastly urbanised Mediterranean coastline and serving as one of the few remaining nesting beaches in the area), where suitable nesting sites are increasingly inaccessible, is visited annually by two endangered marine turtle species. Furthermore, some of the few remaining isolated caves for the critically endangered Mediterranean Monk seal are located in the adjacent region. As the area’s future civil servants, educators and decision makers, local schoolchildren are therefore the main target audience since the IMS campus has previously been under considerable pressure from coastal development planners. Since 2015, DTK has been supported by the city of Mersin Greater Municipality. The Municipality provides transport, snacks and ‘bags for life’ (including a marine sciences information pack prepared by IMS-METU). Academic staff and personnel volunteers of the Institute undertake the student training, utilizing their particular areas of knowledge, results and expertise. The programme has so far provided training to a socially diverse range of over 6000 local schoolchildren. The consequences of anthropogenic activities with particular reference to biodiversity loss and marine litter are explained through visual presentations, team game, short videos, campus tour and demonstrations during a hands-on mini workshop (on global ocean currents, fish and zooplankton diversity, microplastics and marine genetics). Students complete three evaluation questionnaires: at the beginning and end of the half-day training period and in their school classroom one month later. Preliminary analysis of questionnaires demonstrate that the environmental awareness training provided by the DTK programme proves very effective in changing littering behaviour as well as creating awareness and appreciation of biodiversity. Such a University-Municipality partnership has to date proved to be both effective and sought-after and could be an inspirational model for many other cities throughout Turkey.

An Economical Ocean Science Platform You Can Afford

Mr. Richard Baldwin ¹

1. Ocean Sailing Platforms

The purpose of this poster session is to introduce you to an economical scientific ocean platform that people can afford. Learn how you, your school, or university can send out a scientific platform to collect ocean data on such things as water & air temperature, pH, salinity, chlorophyll and oxygen concentration. This is an outgrowth of another company called Educational Passages that sends miniature sailboats into the ocean to study winds and currents.

Miniboat Rsearch Company is a new company that is now working to add sensors and steering capabilities directly from your computer. We are working collaboratively with the School of Marine Science at the University of Maine, their Marine Science Club, and the United Technology Center. This collaborative will also work on developing computer steering so students and others will be able to guide their sailing platforms in the ocean winds and currents. While these boats are not yet ready to sail the seas we expect to be launching our 1st one in July 2019 with the University of Cape Town and the Two Oceans Aquarium in July.

Come see how this collaborative between the Miniboat Research Company, the universities, and the technical center are working to develop an economical research platform that schools can afford.

Richard Baldwin

July 5, 2018

An Economical Scientific Ocean Research Platform

*Mr. Richard Baldwin*¹

1. Ocean Sailing Platforms

Presentation Application

EMSEA 2018

Title: An Economical Scientific Ocean Research Platform

Abstract:

This presentation will build on the one-hour presentation I gave at the 4th EMSEA Conference in Belfast, Northern Ireland. This presentation was on Educational Passage's non-profit educational program using miniature unmanned GPS monitored sailboats. EP has now launched over 160 boats in the Atlantic & Pacific Oceans and in mid-July will be launching a boat off the Cape of Good Hope with the University of Cape Town, the Two Oceans Aquarium and many South African students. Following my presentation in Northern Ireland, North Atlantic Research Alliance officials approached us and stated they thought our program could be very effective in engaging the public in the importance of maintaining the sustainability of our oceans and they "endorsed our program".

Since 2016 Educational Passages has established two way GPS communications with their boats which has allowed us to start installing scientific sensors. This has now allowed us to start working towards adding steering capabilities where students will be able to steer their boats at sea from their home computers. Our ultimate goal is to develop an economical scientific ocean platform for high school and entry level college students.

This presentation will briefly review the development of Educational Passages miniboat program and their many phenomenal ocean passages. It will quickly move on to sensor development, computerized steering, and how we are working collaboratively with universities, marine science clubs, and technical schools. The goal is to develop economical scientific ocean platforms to measure air & sea temperatures, oxygen concentration, pH, and chlorophyll that would be affordable to our public schools and universities.

Note: I will also apply to do a poster presentation.

Richard Baldwin

June 25, 2018

An example of multicultural and multidisciplinary approach to marine education: the Erasmus Mundus Master in Maritime Spatial Planning

Mr. Federico Fabbri¹, Mrs. Elena Gissi¹, Mr. Francesco Musco¹

1. University IUAV of Venice

The presentation will focus on the Erasmus Mundus Master Course on Maritime Spatial Planning (MSP) and its international network starting from a description of MSP as a multidisciplinary educational and professional subject.

The process behind the Master implementation implied the creation of an international partnership between three universities and a large network of affiliated institutions, the submission of the didactic project structure for approval to the European Commission and finally its implementation through students' involvement for a two-year period for each edition of the Master, which started in 2013 and it is now at its 5th edition. The Master was designed with a strong multicultural and multidisciplinary approach, indeed students from different backgrounds are involved and the participation of a maximum of 3 students from the same country is allowed, in order to balance geographical representation. Erasmus Mundus scholarships are granted to enable the participation to the Master to European and non-European candidates, following specific criteria for students awarding for the 2 years duration of the Master.

The experience of the Master from a student's perspective will be described. The Master is developed between 4 semesters. Three of the four semesters take place in three respective academic institutions in three different countries, giving the students the challenging and appealing opportunity to study in different social and professional contexts while creating a wide network of friendships and contacts both among students themselves and among students and professionals involved as members of the teaching staff. One of the four semesters implies an internship experience in academic or non-academic institutions which gives students the opportunity to test themselves in the professional dimension of MSP.

The achievements of the Master students and their transition into the professional world as 'Marine Planners' will also be introduced with some example and representative statistics.

Finally, the three MSP projects (ADRIPLAN, SIMWESTMED and SUPREME) developed by University IUAV of Venice (Master coordinator) will be presented to provide an example of how MSP projects are implemented to support sustainable management of the marine space and to introduce the team working on it, which represents an illustrative example of the multidisciplinary working pool specific of MSP.

Blue School PT: Evaluating the Implementation Model

*Dr. Raquel Lorenz Costa*¹, *Dr. Bernardo Mata*¹, *Dr. Fernanda Silva*¹, *Dr. Patrícia Conceição*¹, *Dr. Vanessa Batista*², *Prof. Ana Noronha*²

1. DGPM - Directorate General for Maritime Policy, 2. Ciência Viva

For the last school year, the Portuguese Ministry of the Sea has been implementing the Blue School programme, aimed at Portuguese schools all over the country.

In last year's EMSEA Conference, we presented the structure of this national ocean literacy programme that was just about to begin. In 2018, we intend to reflect on its first year of implementation. What was achieved, what needs improvement, and what we learned along the way.

We have been conducting a qualitative evaluation of the Blue School programme in order to validate and adjust the current implementation model. We are getting feedback from teachers, students and partner institutions, through semi-structured interviews. We intend to share these findings and make recommendations for other countries who may consider creating their own national Blue School programme.

The Blue School concept has been discussed in European marine education forums like EMSEA. The definition of an European concept was part of the "Sea Change" project where one of our partners (Ciência Viva) took part. Inspired by the creation of this European Blue School concept, we developed a Portuguese Blue School concept and implementation model. It marked the first time that a Blue School programme was actually being implemented in the field. As of June 2018, we have reached 61 schools and over 8000 students in this pilot year. And what is a Blue School? A Blue School must develop an educational project about the ocean, linking different school subjects and levels. This project must accomplish a set of criteria that include encouraging students for action and decision-making in ocean-related issues, developing hands-on activities, and involving local communities and marine stakeholders. One of the major goals of this programme is precisely to get these players (industry, universities, institutions...) actively invested in an effective education about the ocean. Blue School PT has currently more than 40 partners around the country, each one with a specific educational action/initiative/programme for Blue Schools.

In conclusion, the Blue School programme promotes an integrated political strategy for marine education capable of engaging all sea sectors, with the ultimate goal of improving the level of Ocean Literacy among younger generations. It has been highlighted as a successful Ocean Literacy programme by the Intergovernmental Oceanographic Commission of UNESCO, and we hope that this Portuguese approach, with its achievements and learning opportunities for improvement, may inspire the development of an international Blue School model.

Bringing offshore wind energy in the classroom

*Mrs. Ruth Teerlynck*¹

1. Horizon Educatief vzw

Horizon Educatief is a small educational organization, perfectly located near the beach in Ostend. It's our mission to help children and adults to (re)discover the beauty and endless possibilities of the sea. Horizon Educatief conducts workshops for all ages. The sea flows through all workshops and every workshop focuses on one of these three topics: nature and environment, historical heritage and world citizenship and sustainability.

In cooperation with the Belgian Offshore Platform (BOP), Horizon Educatief created a workshop with offshore wind energy as main theme ("Project Sea Wind"). 11 to 12 year young children discover how renewable energy works and why it's important to invest in renewable energy sources. BOP finances the project which allows us to conduct the workshop for free in the class room. The workshop starts with general information on renewable energy and focuses more deeply on offshore wind energy. The pupils discover different professions that play an (important) role in the implementation of wind energy parks at sea. Each pupil has to choose one of the professions: biologist, electrician, journalist, geographer and engineer. In small groups from 3 to 5 children, they have to accomplish a task assigned to them. By compiling all assignments, the pupils discover the complexity of installing offshore wind energy parks.

The workshop is perfect for introducing the children to Blue Growth. It uses the principles of STEM and helps children to team up with each other, to analyze problems and to think in a problem-solving way. It stimulates their creativity and they learn to discuss. Above all, it's a fun workshop to do.

During my presentation I will give an overview of 'Project Sea Wind'. I will propose some ideas to the audience of how to implement topics such as jobs, Blue Growth, offshore wind energy and renewable energy in a workshop for the last grade of a primary school.

Capturing our Coast: Innovation in UK marine citizen science

Ms. Stephanie Dickens¹, Ms. Jade Chenery¹, Dr. Jane Delany¹, Dr. Heather Sugden¹, Dr. Stuart Jenkins², Dr. Siobhan Vye², Ms. Hannah Earp², Ms. Debbie Winton³, Dr. Sue Hull⁴, Dr. Nicky Dobson⁴, Dr. Nova Mieszkowska⁵, Ms. Leoni Adams⁵, Ms. Hannah Wilson⁵, Ms. Justine Millard⁶, Dr. Leonie Richardson⁶, Dr. Gordon Watson⁷, Ms. Zoe Morrall⁷, Ms. Sarah Long⁷, Prof. Michael Burrows⁸, Dr. Hannah Grist⁸, Mr. Peter Lamont⁸

1. Newcastle University, 2. Bangor University, 3. Earthwatch Institute, 4. Hull University, 5. Marine Biological Association, 6. Marine Conservation Society, 7. University of Portsmouth, 8. Scottish Association for Marine Science

Capturing our Coast (CoCoast) is the largest coastal citizen science project of its kind undertaken in the UK, enabling volunteers to participate in field-based hypothesis testing. Led by Newcastle University, the project is a unique collaboration of NGO's, universities and research institutes, which aims to explore the extent to which members of the public can contribute robust and meaningful data to underpin ecological science, policy and conservation measures. Together with our ~3,000 passionate volunteers, we have created a national community of coastal surveyors.

Abundance and distribution data for key indicator species will contribute to our understanding of how intertidal species are responding to changes in temperature or other stressors. Volunteers have also participated in conducting targeted experimental observations, such as how ecological communities recover from storm disturbance and the variation of these patterns of recovery across the UK. Examples of our activity tailored to policy needs, includes the development of the 'CoastXplore' app, collating information on coastal usage by humans. Our portfolio of provision for the volunteers includes family-friendly surveys, and social events with the specific goal of enhancing retention and the volunteer experience. This presentation will overview of the Co-Coast citizen science model, and discuss the potential capacity of citizen science in marine evidence gathering.

Citizen science: a successful tool for monitoring biodiversity in Marine Protected Areas

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1. Istituto Comprensivo Statale ISA2 “2giugno”, 2. Istituto di Scienze Marine del Consiglio Nazionale delle Ricerche (ISMAR-CNR), 3. Dipartimento STEBICEF, Università di Palermo

In the last few decades, anthropogenic activities, introduction of Non-Indigenous Species (NIS, i.e. organisms introduced outside of their natural range), and climate changes, have significantly affected Mediterranean marine biodiversity and ecosystem functioning (1, 2). All that is also true for Marine Protected Areas (MPAs), whose major aim is biodiversity conservation. Therefore, monitoring plans are strongly needed, and the creation of public awareness campaigns might be effective tool to plan management and conservation strategies in MPAs. Since intensive monitoring programs could be very expensive, citizen science, involving citizens in science (including conservation, natural resource and environment), could be a useful tool for gathering data that would otherwise be impossible to collect because of limitations on time and resources (3). Therefore, citizen science may have management, awareness, education and scientific implications. We report the experience of two citizen science projects carried out in MPAs. Precisely, the project “Blue Paths” and the project “*Caulerpa cylindracea*– Egadi Islands”.

“Blue Paths”, ideated by the Unified School District ISA 2 “2 Giugno” of La Spezia, with the partnership of Marine Parks and Research Centers (CNR-ISMAR and DLTM) aimed at: 1) monitoring the coastal flora and fauna in selected MPAs within the Ligurian and Tyrrhenian Sea, and 2) promoting a scientific literacy in marine science directly involving citizens. Researchers, teachers and volunteers worked together to help school students in the identification of the organisms collected during the surveys. In addition to the high educational value (4), the project had significant scientific fallouts. In particular, a 5 years campaign (2014-2018) carried out at Pianosa Island, in the National Park of Tuscan Archipelago, allowed to record both time series of data and the presence of the NIS *Aplysia dactylomela*, a yellowish-brownish opisthobranch with black rings (5). The project “*Caulerpa cylindracea*– Egadi Islands”, sponsored by the STEBICEF Department of the University of Palermo and by the Egadi Islands MPA, aimed at monitoring the spread dynamics of the “sea grape” *C. cylindracea* within the Egadi Islands MPA. The project registered 156 sightings of the alga and allowed to gather useful information on this alga but also on others NIS (6). It also allowed to highlight as the presence of *C. cylindracea*, favoured the settlement of another NIS, the tube-building sabellid *Branchiomma bairdi*. In June 2017, another citizen science project “Aliens in the sea”, also sponsored by the STEBICEF Department and aiming at collecting data on 19 marine NIS along the Italian coasts, was launched.

Citizen science is a rigorous process, indistinguishable from conventional science apart from the participation of volunteers. When properly designed, carried out, and evaluated, citizen science can efficiently generate high-quality data, and help to solve problems.

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EMSEA Med: a vibrant network for the diffusion of Ocean Literacy in the Mediterranean region

***Dr. Monica Previati*¹, *Dr. Maria Cheimonopoulou*², *Dr. Panayota Koulouri*³, *Dr. Giulia Realdon*⁴, *Dr. Melita Mokos*⁵, *Dr. Athanasios Mogias*⁶, *Dr. Theodora Boubonari*⁶, *Dr. Theodoros Kevrekidis*⁶**

1. Underwater Bio-Cartography (U.BI.CA s.r.l), 2. Hydrobiological Station of Pella, Ministry of Rural Development, and Food, Greece, 3. Institute of Marine Biology, Biotechnology & Aquaculture, Hellenic Centre for Marine Research, Crete, 4. University of Camerino, Italy, 5. University of Zadar, 6. Democritus University of Thrace

EMSEA Med is an international Mediterranean group of educators and scientists/researchers. It was established in 2015 within EMSEA on the basis of the common regional origin and of the shared interest for the promotion of OL along the Mediterranean Sea. This “Sea in the middle of the Earth”, the largest and deepest enclosed sea on Earth, cradle of western civilization, global diversity hot spot, home to half billion people and world leading touristic destination, displays unique features that are under threat. That makes the diffusion of OL in this area necessary as OL citizens are able to make informed and responsible decisions regarding the Mediterranean Sea and its resources.

Since 2015 EMSEA Med group issued the following resources: (a) the translation of OL principles and concepts into different languages (GR, ES, IT) and (b) a Mediterranean Sea Literacy (MSL) Guide, containing the Mediterranean Sea Literacy principles and concepts, still undergoing revision and progressive refinement.

In the same period EMSEA Med group promoted the diffusion of OL through international conferences (EMSEA conferences 2016,2017; EGU conference 2018), as well as through a regional group page on EMSEA website and a Facebook page with updates and news on MSL, OL and other related issues.

EMSEA Med members also organized joint events (World Oceans Day and the European Maritime Day) and implemented educational activities for schools and general public, included, in one country, teacher-training courses.

In order to integrate the educational activities, EMSEA Med members from Italy, Greece and Croatia proposed to start a research program to investigate and measure OL among younger students of the Mediterranean countries. The measurement of OL will help us to: a) assess the quality of marine education in national education systems across the Mediterranean Sea and b) have a baseline for better promoting OL in the future.

For this purpose a questionnaire was drafted grounding on OL and MSL principles and following the guidelines of OL Scope and Sequence for Grades K-12 (NMEA, 2010). The questionnaire includes multiple-choice questions and attitude questions, addressing the students’ knowledge and opinions about the ocean and the Mediterranean Sea.

Two versions of this tool (for ages 8-12 and 13-15, primary and middle school respectively) were designed and developed in English, translated into Italian, Greek, and Croatian, and pilot tested in the respective countries. About 800 questionnaires have been collected (500 from Italy, 250 from Greece and 100 from Croatia). This activity is at its early beginning and further research is needed concerning validity and reliability.

OL approach is quite new for Mediterranean countries and exceeds the traditional naturalistic teaching of ocean sciences, so the collection of data and the development of new tools will help to evaluate the outcomes of the initiative and to improve Mediterranean Sea Literacy among future citizens.

*The views and opinions in this abstract are the author’s own and do not necessarily reflect those of her institution

** Part of this project has been funded by the European Union’s Horizon 2020 project “Green Bubbles”

Engaging the public with deep-marine ecosystems: An outreach portfolio for the ATLAS Project by Dynamic Earth

*Ms. Emma Paterson*¹

1. Dynamic Earth

ATLAS is a trans-Atlantic research project funded by the EU under the Horizon 2020 Blue Growth call. It aims to increase our understanding of deep Atlantic marine ecosystems and their connections with other areas. ATLAS will also improve our ability to predict how changing environmental conditions might affect them. The information gathered will allow ATLAS to inform scientists, governments and businesses on the best ways to protect these ecosystems from issues such as climate change, pollution and certain fishing techniques. This knowledge will support sustainable growth in the marine and maritime sectors. Engaging the public with the outcomes of ATLAS is a key part of the project.

Dynamic Earth, an Earth and Environmental Science educational charity based in Edinburgh, is tasked with creating an Outreach Portfolio for ATLAS. Here we describe various engagement tools and activities in development for this portfolio. These include new materials and innovative ideas for running family drop-in events and learning resources for Primary and Secondary school pupils, as well as concepts for an update to Dynamic Earth's Oceans gallery. The Portfolio will form the basis for Dynamic Earth's 2019 public engagement programme in Edinburgh and at regional science festivals across Scotland, typically reaching audiences of around 10,000 families and schoolchildren at the festivals while over 60,000 visitors to the centre will participate in ATLAS-related activities. It will also provide inspiration and resources for ATLAS partners and other centres wishing to run similar activities, utilising established Ocean Literacy networks such as Sea Change and ResponSEAbLe to ensure the widest possible dissemination.

Exploring methods for integrating Ocean Literacy into pre-service teacher training and teacher professional development workshops.

*Dr. Noirin Burke*¹, *Ms. Anna Quinn*¹, *Mr. Padraic Creedon*¹, *Dr. Cliona Murphy*², *Ms. Cushla Dromgool Regan*³, *Mr. Brendan Allard*¹

1. Galway Atlantaquaria, 2. Dublin City University, 3. Marine Institute

The Marine Institute is Ireland's State agency responsible for marine research and development. In 2006, they identified the importance of developing and working with the education community to introduce marine science and related subjects into the classroom and established the Explorers Education Programme™. Designed to inform teachers and students of Ireland's marine and maritime heritage, and raise awareness of the value, opportunities and social benefits of our ocean wealth, the programme has grown over the last 12 years to reach over 700 teachers in the 2017 – 2018 academic year, involving outreach centres around Ireland. This engagement was carried out through professional development workshops in collaboration with the Department of Education and Skills (DES) and pre-service teacher engagement in School of STEM Education, Innovation and Global studies, Institute of Education, Dublin City University (DCU). These workshops took two distinctive formats. The first consisted of a two hour introduction on Ocean Literacy and methods for incorporating into the primary school science curriculum, which was carried out with second year pre-service teachers in DCU (n=172). The second was a 5 day teacher professional development workshop, which took a total of 20 hours, and was carried out in collaboration with regional education centres in Galway, Tralee, and Blackrock (n=47). Participants in all workshops were asked to complete a self-assessment sheet by rating their knowledge, attitudes and values, and actions for the Ocean before and after engagement. They were also asked to list three simple actions which they could take to help the ocean and note any other suggestions for protecting the marine environment. An increase in all aspects evaluated was identified for both teachers and pre-service teachers. Teachers showed the highest increase in knowledge and actions, while pre-service teachers showed the highest increase in attitudes and values. Variations in the number of simple actions and further suggestions listed were also noted, with teacher workshops scoring highest. This may be linked to the duration of each workshop, and may highlight the importance of the length and type of the engagement on impact.

Going with/against the flow: the challenges of an immersive marine science education

*Mr. Harry Breidahl*¹

1. Nautilus Educational

This presentation will draw on a case study of a long-standing and well-received pre-service teacher education unit at Monash University in Australia. This program began in 1999, partly as a response to a major national initiative called Coastal and Marine Studies in Australia. Since that time the unit has evolved and a range of specialist and generalist lecturers have coordinated and reworked unit. Most recently, it was redesigned with a strong focus on the concept of Ocean Literacy. The first key element of the program is that it offers undergraduates direct experience of local coastal and marine habitats and, as such, links them to the wider considerations of sense of place and place attachment. It was also set-up to actively engage students in immersive, place-based and culturally competent learning. As a result, a second key element of the program is that it is based in local schools where undergraduates work directly with school students. The third key element relates to curriculum making and using the seven Ocean Literacy Principles as an organizing framework for key concepts and activities. Finally, the main aim of this presentation is to show how all of the elements outlined above could be easily translated to a range of other undergraduate or professional development programs internationally.

Graduates becoming teachers and their marine literacy

*Dr. Thomas McCloughlin*¹, *Ms. Cushla Dromgool Regan*², *Dr. Noirin Burke*³

1. Dublin City University, 2. Marine Institute, 3. Galway Atlantaquaria

In Ireland, Marine literacy, as a subset of scientific literacy, is critical for teachers to allow children to consider the marine as a source of employment in a wide range of industries; as the fundamental driver of our climate; of the source of food and materials; of transportation which otherwise they remain unaware of, and which have taken on renewed focus in light of the current BREXIT negotiations as of 2018. Therefore we consider marine literacy to go beyond 'knowledge': it is something that comes about through interpersonal exchange of experience, which in the past relied on person-to-person transmission and it is constructed. As this transmission has been interrupted, marine literacy must now be 'taught' or learned in new ways. To that end we hypothesise that young people lack basic content knowledge as well as an integrated higher level understanding of humanity's relationship with the marine and that this propagates into adulthood. It is further hypothesised that young people from specific backgrounds hold a skewed understanding of the marine environment at best, or are 'marine blind' at worst. It is hypothesised that children lack basic content knowledge as well as an integrated higher level understanding of humanity's relationship with the marine. The use of idiographic analysis demonstrates the commonality of this 'lack'. A sample of n=45, mean age= 24.2yrs, primary level graduate masters student teachers at Dublin City University's Institute of Education - the largest teacher education institute in Ireland - completed a marine knowledge prior test and following an intervention a marine literacy test. The tests probed for content indicators before the intervention, and perceptions of their learning in the after test. The intervention involved a short marine module delivered by Dublin City University and the Marine Institute's Explorers Education Programme™. The resulting data was analysed using standard statistical methods for non-parametric data which established a positive differential across the implementation of the intervention. The relationships between the learners was of particular interest and showed commonality of perceptions of which activity was appropriate for their understanding of the teacher's role in primary education. To that end an adaption of repertory grid analysis was employed. This demonstrated the student teachers' personal constructs and provided insights into their construction of understanding of marine knowledge. It is expected that as a result, the intervention will be broadened to include further marine literacy training of student teachers at the graduate masters level and builds on previous work with undergraduate student teachers. Future work will attempt to triangulate student teachers at both undergraduate degree, graduate masters, and specialist biology majors in the near future.

How do aquariums raise awareness about climate change: the example of Oceanário de Lisboa's educational programmes.

Dr. Diogo Geraldés¹, Dr. Teresa Pina²

1. Ocenário de Lisboa, 2. Oceanário de Lisboa

The Earth's climate has changed throughout its history, with several glacial cycles arisen and disappeared. Despite most of climate changes have occurred due to small modifications in the Earth's orbit, with the beginning of industrial revolution, human activities have accelerated the natural processes, leading to global warming and extreme phenomena, such as hurricanes, tsunamis and floods.

With more than 650 000 000 visitors every year, public aquariums provide a privileged access to the marine world, promoting an inimitable experience, where visitors can emotionally connect to the ocean. They create an exceptional environment through their exhibitions, which represent a unique and credible channel for communicating issues affecting the marine environment.

Since 1999, Oceanário de Lisboa has engaged more than 1 300 000 participants in its educational programmes, promoting ocean literacy for all ages, from babies to youngsters and seniors. Nowadays, Oceanário has more than 25 educational programs prepared for schools, from pre-K to high school, aligned with and upgrading the national curriculum in different subjects, such as Biology, Portuguese language, History, Maths and Geography. In the school year 2018/2019, Oceanário will develop a special agenda, focused on climate change and the role of ocean as the major influence on weather and climate. With the goal to change behaviours and raise awareness about this issue in students between 4 to 18 years old, four educational programs will be created, aligned with UNESCO Sustainable Development Goals and the Principles of Climate Literacy. Through several educational approaches, such as storytelling and inquiry based science education, participants will travel around different scenarios, where they have to solve problems by integrating their knowledge, scientific data and real news, in order to make informed, conscious and responsible decisions regarding the ocean and its resources and to communicate about their findings and possible solutions. Their choices will make the difference in the future of the ocean, and thus in the future of the planet.

Simultaneously, Oceanário will promote workshops for teachers on the same subject, where a set of activities and educational resources will be provided in order to enable them to mobilize, empower and engage the school community.

Oceanário de Lisboa aims to engage 10 000 students in its climate change educational programs, and train 140 teachers with knowledge and experience to give a step forward for a blue generation.

Increase the Marine Litter' problem knowledge and awareness through Citizen-Science activities: an assesement study

*Dr. Marina Locritani*¹, *Dr. Silvia Merlino*², *Dr. Marinella Abbate*³

1. Istituto Nazionale di Geofisica e Vulcanologia, 2. Istituto di Scienze Marine del Consiglio Nazionale delle Ricerche (ISMAR-CNR), 3. Agenzia nazionale per le nuove tecnologie, l'energia e lo sviluppo economico (ENEA)

Citizen Science approach has proven to be an efficient way for to deal with scientific investigations, particularly in the environmental field. It allows collecting a large number of data in sufficiently short time, thanks to the collaboration of volunteers with researchers. This approach is also useful to make citizens aware, in a more direct and effective way, of environmental problems or scientific issues, and so it becomes a method of fostering education and raising awareness and public understanding of science.

This study deal with a quantitative assessment of student' attitude and behaviors related to marine-litter before and after their participation in a Citizen-Science experience devoted to monitor Anthropogenic Marine Debris (AMDs) in a specific Marine Protected Area (MPA), to help researchers during the cataloguing activities of AMDs and to perform a first data analysis. Citizen-Science actions have been undertaken during the monitoring programme "SEACleaner", that aims at contributing to the collection of current data on macro- and micro-beached Marine-Litter in the sensible area of "Pelagos Sanctuary", in Mediterranean Sea, and to raise awareness of this environmental problem. The used protocol - based on the Guidelines on Survey and Monitoring of Marine-Litter UNEP/IOC - is easy to use, suitable for a wider circle of people and, at the same time, methodologically sound and comprehensive. SEACleaner project involves high school students as principal protagonist in this kind of inquiry, approaching them to scientific methodology by analyzing the situation of the places where they live, as Marine-Litter problem is often not treated in standard scholastic programs. This approach produced interesting fallouts that have affected both the research sector in the field of marine pollution and the scientific and environmental education. This communication focuses on the role of the Citizen-Science' approach as an effective vector to promote knowledge, developing skills and cognitive abilities and raising young people awareness of this problem, and so foster the emergence of correct behaviors. A specially conceived questionnaire was used to verify the validity of such an approach, evaluating the effectiveness of these activities in terms of acquisition of knowledge and skills in the field of marine pollution and, also, in terms of increasing of awareness of this environmental problem. Results, statistically assessed and compared with similar ones obtained by other authors, attest that there was a change of perception about the faced problem in the students participating to the Citizen-Science experience during SEACleaner activities. Not only their recognition of the marine litter problem increases after intervention, but also do their concern about the issue. Students' perceptions change as during their stage they personally realize which are the principal AMD' typologies present on the beaches, what may be their origin, and the importance of the presence of rivers and/or of coastal industries or productive activities. Involving students in real monitoring programs could be a perfect way to educate the younger generation about this issue, leading to join the scientific/environmental value with the educational one.

Kids Taking Action for the Ocean

*Dr. Meghan Marrero*¹

1. *Mercy College*

Overview. The ocean is our planet's most significant feature, and yet is being plagued by numerous environmental concerns, including climate change, overfishing, and pollution. Scientists, educators, science communicators, and community organizers alike stress that today's youth will effect change to save our ocean. But, what factors lead to students taking action for change while they are young? This qualitative study of students ages 10-18 in the United States used qualitative methodologies to uncover the factors that lead to students feeling 1) compelled to engage in positive ocean behaviors and 2) empowered to do so.

Data Collection and Analysis. Data sources included an online questionnaire, student classwork, and teacher and student interviews. Qualitative data analysis allows for discovery, for themes to emerge from a variety of data sources rather than testing pre-determined hypotheses, and in this case allows the ideas of students about positive environmental behaviors to come to the forefront. Merriam (1998) tells us that “[q]ualitative researchers are interested in understanding the meaning people have constructed, that is, how they make sense of their world and the experiences they have in the world” (p. 6).

Findings. Data are still being analyzed for this study, but a few themes are emerging from initial analysis.

Theme I: Student action within local communities. Many of the aforementioned environmental issues are beyond the average child's realm of influence. That is, a 10-year-old cannot generally make decisions about how s/he uses fossil fuels, where his/her food originates, etc. However, kids can make personal decisions related to issues such as single-use plastics and water use. A kid can choose not to use a straw in a restaurant, to refuse a plastic bag at a store, to carry a reusable water bottle, or even influence his or her school to avoid having these items available in the cafeteria. Similarly, a young person can choose to take shorter showers, or advocate that that leaky pipes at school be fixed. This theme was evident in several data sources, in which kids noted that they were able to make changes first in their personal lives, then in their communities, by sharing what they had learned with adults.

Theme II: Protecting animals and ecosystems. While some students indicated that the ocean was important to humans for supporting human health, providing oxygen, etc., the most common reason that students cited for wanting to take positive action for the ocean was to protect animals and/or ecosystems. Students primarily discussed charismatic megafauna and how they are affected by, for instance, marine debris.

Theme III. Barriers to student action. Students identified a number of barriers that prevented their action projects from being as successful as they had hoped. These included time, lack of cooperation from peers or community members, and being ignored by politicians.

The presentation will go into much greater depth on findings from the study, including supporting quotes from students and teachers, and discuss implications for marine education practice.

MARINA exhibition, or how to explore the seven seas and make marine research and innovation relevant to all

*Ms. Iwona Gin*¹, *Ms. Helin Haga*², *Mr. Sander Kask*²

1. Nausicaa, National Sea Experience Centre, 2. AHHA

Helping citizens of all ages understand the importance of the world's ocean and how marine Responsible Research and Innovation (RRI) can unlock its huge potential is the aim of the MARINA travelling interactive exhibition. It emphasises the role of public engagement, science education, open access, ethics, gender balance and governance in empowering society to meet current challenges and contribute to the well-being of humanity through sustainable use of marine resources.

A special focus is given to marine biotechnologies, deep-sea mining, sea transportation and marine renewable energy while the exhibition showcases how the treasure from the sea benefits our daily life whether we live on the coast or in the hinterland.

Consisting of hands-on displays, the MARINA exhibition encourages active participation of the visitor who has to take decisions and act upon them. In this way they learn to engage in building a sustainable future based on Blue Growth and thus become a marine literate, Blue Society.

The exhibition is developed in the framework of the MARINA project by the science centre AHHA in Estonia and Nausicaa Sea Experience Centre in France.

MARINA project: bringing all actors of Blue Growth together

***Mrs. Delphine El-Khassawneh*¹, *Dr. Fernando Ferri*², *Mr. Ned Dwyer*³, *Mr. Sasa Raicevich*⁴, *Dr. Mato Knez*⁵, *Mrs. Anca Gheorghe*⁶, *Mr. Manuel Cira*⁷, *Ms. Helin Haga*⁸, *Mr. Rogerio Chumbinho*⁹, *Dr. Yiannis Laouris*¹⁰, *Mrs. Mara Gualandi*¹¹, *Mr. Hans Thor Andersen*¹², *Mrs. Husne Altiok*¹³, *Mrs. Xenia Schneider*¹⁴, *Mr. Slawomir Sagan*¹⁵, *Dr. Michèle Barbier*¹⁶, *Mrs. Natália Silva*¹⁷, *Mr. Albert Scricciu*¹⁸, *Mr. Cathal O'mahony*¹⁹, *Dr. Maddalena de Virgilio*²⁰, *Mrs. Maggie Kossida*²¹**

1. Nausicaa, Centre National de la Mer, 2. IRPPS CNR, 3. EurOcean, 4. Italian National Institute for Environmental Protection and Research, 5. CIC nanoGUNE, 6. Mare Nostrum NGO, 7. World Ocean Network, 8. AHHA, 9. Smartbay Ireland Limited, 10. Cyprus Neuroscience and Technology Institute, 11. Agenzia per la Promozione della Ricerca Europea, 12. Aalborg Universitet, 13. Istanbul Universitesi, 14. Xpro Consulting Limited, 15. Institute of Oceanology Polish Academy of Sciences, 16. Sciencethics, 17. Fundo Regional Para a Ciência e Tecnologia, 18. NIRD GeoEcoMar, 19. University College Cork, 20. Osservatorio del mare a molfetta, 21. SEVEN Solutions

MARINA is a European collaborative project that has set up an all-inclusive Knowledge Sharing Platform bringing together existing networks, communities, online platforms and services. This unique online environment fosters Blue Growth by engaging with all stakeholders in marine and maritime fields: researchers, citizens, Civil Society Organisations, science communicators, industry, businesses, and policy-makers.

It is supported by 37 local and 8 international participatory European workshops, which addressed marine biotechnology, sea transportation, deep-sea mining, marine changes caused by climate, renewable energy (wave, wind, tidal), tourism and coastal cities, fishing and aquaculture, and pollution caused by human land and sea pressures. So far, the workshops have actively engaged more than 1,100 actors in 12 European countries. By using participatory and interactive workshop methods, we created a forum for debating, exchanging knowledge, sharing best practices and co-creating solutions to tackle marine challenges and bring economic and environmental sustainability through Blue Growth.

All our activities have resulted in a collection of lessons learned and best practices in the framework of Responsible Research and Innovation (RRI). RRI is an ambitious challenge launched by the DG Research and Innovation in 2012 for the creation of a research and innovation policy driven by the needs of society and engaging all societal actors via inclusive participatory approaches. RRI includes six dimensions: public engagement, gender equality, science education, open access/open science, ethics, and governance. In this context, the MARINA project is acting at the science-policy-society interface in the specific context of the marine domain. The results of our project been boiled down into the RRI Roadmap for Blue Growth and beyond.

The findings of the workshops corroborate the Blue Society vision developed in the framework of the Sea for Society project, which was funded by the 7th Framework Programme of the European Union. The Blue Society “encapsulates the vision of a new governance model where the marine environment is effectively managed in a way that meets societal needs, whilst protecting ocean capital, giving future generations the opportunity to enjoy and benefit from the services and resources provided by a healthy ocean”.

Marine environmental education through emotions

Ms. CURLISCA ANGELICA ¹

1. Complex Museum of Natural Sciences Constanta/

As in the past, the goal of museums of natural science is to educate the public. Unlike traditional museums, natural science museums that have living heritage bring forward a new way of education - education through emotions.

Topics addressed appeals to empathy with important scientific issues such as environmental protection, global warming, genetic engineering, cloning, etc.

Classical museum exhibitions are “cold”, impersonal, preserving a certain distance between exhibits and the public to protect them (Rasse 2003, 117). These, as well as the silent atmosphere with diffused lights, make you think of sacred spaces, such as churches.

Unlike these, in museums that have living heritage the classical education is supplemented with the emotional one because people tend to enjoy the sight of any living animal.

Presentation of marine species and the problems they face in an environment where live organisms can be seen increase public empathy for the topics presented. **It is the same thing as when students attend in fieldtrips where they see the animals in their environment.**

Participants want to feel, share emotions about what they have seen and are more receptive to environmental issues.

In this paper we present the public’s reactions to marine pollution with plastics after participating in the demonstrations of marine mammals (dolphins and sealions).

Marine knowledge transfer between students of different educational levels

Dr. Melita Mokos¹

1. University of Zadar

European coast and sea has a great capacity to provide economic growth and jobs. Sustainable blue growth is necessary to ensure healthy sea for the future generations. Ocean literacy is one of the crucial steps to ensure sustainable blue growth. In order to achieve this goal, skilled and ocean literate professionals are needed in blue sector.

At the University of Zadar, Croatia, a new graduate programme is developed: “Sustainable management of aquatic ecosystems” as a result of the “Blue Smart” project financed by European Maritime and Fisheries Fund (EMFF). As a part of this programme, a new course “Sea and society” was developed to ensure that future professionals learn about ocean literacy and its importance for sustainable blue growth. As a part of the course, students organized and performed 12 workshops for elementary school children and high school students, age 8-15. Workshops covered different topic such as: marine biodiversity, ocean acidification, marine litter, sea-grass, oil pollution, sailing principles, integrated multitrophic aquaculture, marine food web, and overfishing. Approx. 250 children participated in these workshops.

Workshops provided an opportunity for intergenerational students’ knowledge exchange and were also a great way of connecting different levels of national education system to inform our next generations about different marine issues and improve ocean literacy at the local level. Overall aim of the course is to contribute to understanding the need for sustainable management of marine resources and achieving UN global sustainable development goal SDG 14: Conserve and sustainably use the oceans, seas and marine resources. The course also improves the connection between scientific community and society through active participation of students in knowledge transfer into the local community.

Ocean Literacy and Blue Growth: an innovative project linking science education and marine economy

***Dr. Giulia Realdon*¹, *Mrs. Sandra Fabris*², *Mrs. Giuliana Candussio*², *Ms. Martina Rossi*³,
*Dr. Maria Cheimonopoulou*⁴, *Dr. Panayota Koulouri*⁵, *Dr. Monica Previati*⁶**

1. University of Camerino and Associazione Scienza under 18 Isontina, 2. Associazione Scienza under 18 Isontina, 3. MARE FVG - Maritime Technology Cluster FVG, 4. Hydrobiological Station of Pella, Ministry of Rural Development, and Food, 5. Institute of Marine Biology, Biotechnology & Aquaculture, Hellenic Centre for Marine Research, Crete, 6. Underwater Bio-Cartography (U.BI.CA s.r.l.)

Ocean Literacy (OL) is a multifaceted issue, involving not only scientific knowledge, but also environmental, societal and economical implications.

Within this scenario, Scienza under 18 Isontina and MARE FVG - Maritime Technology Cluster FVG developed an innovative project aimed at promoting OL and blue careers among students of Friuli Venezia Giulia (FVG, Italy)

Scienza under 18 Isontina is a NGO aimed at science communication and environmental education for the schools; MARE FVG is a regional public-private partnership in the maritime technologies domain (shipbuilding, boatbuilding, offshore, transports, infrastructures, logistics, services for navigation and yachting).

The project was born in 2016 to enhance OL in the coastal area of FVG, characterized by important historical links with “Blue Economy”, due to the presence of shipyards - including world leading company Fincantieri, harbours, fisheries, aquaculture plants and coastal tourism.

The specific project objectives are:

- The diffusion of OL with special attention to the links between science, technology and Blue Economy
- The promotion of “Blue Careers” through orientation towards secondary vocational and tertiary education (technical schools, engineering faculties)

The first step was joining partners’ resources for celebrating the European Maritime Day 2017 with the involvement of primary and middle school students.

The partnership continued with the implementation of practical labs on physics topics applied to ship building and sailing. The labs, performed in collaboration with experts and equipment from a governmental research institution (CNR-INSEAN, Consiglio Nazionale delle Ricerche - Rome) achieved a wider school involvement: about 400 students from 20 primary and middle schools of the region who subsequently took part in the European Maritime Day 2018.

To assess the impact of these activities on OL, an investigation on students’ perception and knowledge of OL principles has carried out by administering a questionnaire before and after the practical labs.

The questionnaires, still in progress, were developed within EMSEA Med workgroup starting from previous research, and addressed the 7 OL principles according to the guidelines of OL Scope and Sequence for Grades K-12 (NMEA, 2010).

The preliminary results of this study (middle school pre-test) disclose some interesting findings.

Sample students appear aware of the biodiversity of marine ecosystems, of the marine origin of life and of the marine influence on climate, but they show little knowledge of the global dimension of oceanic circulation and water cycle, as well as of marine oxygen production. Asked about their opinions, sample students seem to perceive their links with the ocean, both on the environmental and societal-economical sides. The completion of the study (pre- and post-tests of the whole sample) will be needed to assess the outcome of the project; meanwhile

we hope that this kind of collaboration may be inspiring for widening the range of educational activities in the field of OL in Italy and abroad.

Ocean Literacy for Workforce Development in the Shipbuilding and Offshore Renewable Energy Sectors in Europe, in Support of the Blue Economy

Ms. Martha Papathanassiou¹, Ms. Lucia Fraga-Lago², Ms. Rosa Fernández²

1. Indigo-Med, 2. Fundación CETMAR

There is no doubt as to the relevance and importance of maritime activities for the global economy, as coasts, the ocean and seas have the potential to deliver a significant increase in use and growth in jobs in the coming years worldwide. In Europe, it became clear through the maritime sector's response to the 2008 economic crisis that innovation-driven processes are now, more than ever, in the spotlight. These, along with the profound changes on a global scale confronted by its industries, by socio-economic and environmental drivers, pose significant challenges to the existing labour market required to support development and innovation in the maritime technologies. The digitization of industrial processes (automation, robotics, Internet of Things, big-data), the rising demand for more sustainable practices, coupled with demographic and geopolitical changes and the exponential increase in accessible knowledge and data, are all crucial factors in the present and future context of the maritime sector. The newly-funded EU ERASMUS+ proposal 'MATES' (Maritime Alliance for fostering the European Blue economy through a Marine Technology Skilling Strategy) aims to cover this evolution in maritime technologies and produce a strategy which will address future skill shortages and contribute to a more resilient labour market, capable of adapting to new scenarios, while safeguarding the well-being of present and future maritime-dependent communities and the competitiveness of the industry.

The MATES Project focuses on the shipbuilding and offshore energy value chains, however the different traditional and emerging activities as well as the stakeholders involved, call for a broader approach. The European strategy created by MATES is based on a series of pilot case studies chosen to demonstrate the viability of the solutions identified, thus creating a platform for a long-term action plan to harness the strategy's sustainability. Ocean literacy is a cross-cutting issue across the MATES Project, thereby multiplying the impact of results and increasing the sectors' attractiveness for talent and investment. Ocean literacy will complement the sectoral approach as a transversal action area since collaboration among education and science communities with industry, society and government will widen the perspective of relevant knowledge and skills and increase opportunities for the labour force in an industry-led strategy.

The inclusion of ocean literacy in MATES will raise awareness and increase the understanding for maritime workers and society at large about the importance of the marine environment, its resources, and of the sustainable performance of the activities based upon the sea. It is expected that ocean literacy activities will create a valuable image of the maritime technologies and the blue economy as an evolving sector providing opportunities for retaining skilled workers and further attracting young talents.

This session will focus on the role of ocean literacy in the training and education of the future workforce for shipbuilding and offshore energy industries. Drawing from experience in Europe, the USA and the Atlantic Ocean Research Alliance Galway Statement transatlantic partnerships, the presenter will provide examples and challenges for future workforce development as a building block for the blue economy.

Out of your depth? From Ocean Literacy to Ocean Science

Dr. Joachim Dengg¹, Dr. Sally Soria-Dengg¹

1. GEOMAR Helmholtz Centre for Ocean Research Kiel

Sometimes, a vivid interest in ocean topics can form a first stepping stone into the world of ocean science: At GEOMAR Helmholtz Centre for Ocean Research in Kiel, Germany, every Friday afternoon 12 to 14 teenagers from different schools meet in the “Friday Researchers Club”. Supported by GEOMAR’s staff, they work together in teams on projects related to various aspects of ocean sciences, e.g. the reaction of mussels to different kinds of environmental stress, the analysis of nutrient and oxygen concentrations in Kiel Fjord, or the technology required for autonomous underwater drones. Projects extend from a few months up to several years, and the pupils gradually evolve from “interested” to “expert”. This approach to “enhanced ocean literacy” poses a formidable and yet rewarding challenge not only to the youngsters but also to their advisors, because it continuously exceeds the limits of the previous experience of both.

This presentation will introduce the format, show examples of the projects carried out by the pupils, and discuss the requirements in terms of time and resources for this type of approach.

Overcoming barriers to ocean literacy

Dr. Sally Soria-Dengg¹, Dr. Joachim Dengg¹, Ms. Anja Blenckner²

1. GEOMAR Helmholtz Centre for Ocean Research Kiel, 2. Lilli-Nielsen-Schule Kiel

In the scientific community, the desire to raise awareness and sensitivity for the oceans among young citizens is great, and the range of actions and programmes offered by many research institutions in Germany to achieve this goal is varied and wide. Many of these initiatives profit mainly pupils attending the local community schools. More often than not, pupils with special needs have been left out and have not been offered the same opportunity not because of the lack of desire, but for many not only because of the lack of special infrastructure and equipment but also, and probably more important, due to the insecurity on the part of the educators/experts about how to deal with disabilities.

The School Outreach Programme of the Collaborative Research Centre 754 at GEOMAR, an ocean research institute, conducted a project with pupils with different types of disabilities, from physical to psychological, from emotional to learning disabilities. The aim of the project is to give the pupils access to ocean experiments and activities, which until then were only offered to pupils in standard schools. The project was done in the pupils' own "turf", in their school, with the scientists bringing in the expertise and materials and the teachers providing invaluable support for both the pupils and the scientists.

The talk will describe the step-by-step process of how we realised this project. What should be considered when planning this kind of project, the difficulties encountered, the project itself and the rewards we gained after.

Racing for Ocean Literacy

*Ms. Lucy Hunt*¹

1. Volvo Ocean Race

‘Sport has the power to change the world’ Nelson Mandela

The Volvo Ocean Race is one of the most extreme sporting events in the world. A 45000nautical mile global sailing race that takes 9 months to complete, engaging millions of people globally and stopping at 12 iconic host cities along the way. For the first time ever in its 43year history the Volvo Ocean Race undertook a Sustainability Programme of which a major part was outreach and education. An Ocean health education programme was developed by marine biologist Lucy Hunt founder of Sea Synergy Marine Awareness & Activity Centre in SW Ireland focusing on ocean literacy principles and solutions to ocean plastic pollution. Lucy has been working in ocean literacy and connecting people with the ocean for over 15 years, with the Volvo Ocean Race as a global platform the education team worked with over 20,000 children onsite educating about ocean literacy principles and solutions to plastic pollution. The online education resources were translated into 7 languages and are now being used by over 80,000 people in 38 different countries creating real positive action for the ocean. The education programme is developed using head and heart principles to emotionally involve students and activate them to be the change. Using the sustainable sport of sailing as a platform for ocean literacy engaged many more people from all walks of life to understand the importance of the ocean and why we need to protect it. The outreach of the Volvo Ocean Race is over 3million people from around the world who were engaged in continuous messaging on ocean health and how to help. One of the racing yachts was called Turn The Tide on Plastic and the race also promoted the UN Clean Seas campaign. Schools took on the Clean Seas campaign and also created further outreach in festivals and St Patricks Day parades bringing ocean literacy to their communities! The Volvo Ocean Race is a great example how using sport as a platform can help to change the world of ocean literacy.

www.volvoceanrace.com/education

Raising awareness about endangered species through storytelling – The Ria Formosa seahorses case study

*Dr. Teresa Pina*¹, *Dr. Vanda Lobo*²

1. *Oceanário de Lisboa*, 2. *Oceano Azul Foundation*

The community of seahorses of Ria Formosa lagoon, Portugal, was considered to harbour one of the highest densities of seahorses in the world. Today, due to the habitat degradation and illegal capture, the seahorses populations run the risk of disappearing if measures to curb are not taken urgently. The Oceano Azul Foundation endeavoured a campaign, which aims to raise awareness and alert the local communities for the wealth of this heritage, the current status of the populations and the causes of its decline. Through four different axis of action (political, scientific, social and educational), the main goal is to engage all the stakeholders in order to eliminate threats, change behaviours, rebuild populations and save the future of the seahorses in Ria Formosa.

The educational axis aimed to reach 8 000 children from 4 to 10 years old, in order to engage these young influencers in the “Saving the seahorses” cause. Communicate complex messages, such as endangered species, with these young audiences requires special skills. Storytelling is considered one of the most effective strategies to capture children’s attention and to encourage them to act as opinion leaders, society influencers and, later on, decision makers.

Oceano Azul Foundation invited well-known children’s illustrator and writer, Ana Seixas and Ricardo Henriques, to create an original book to explain the current situation of seahorses in Ria Formosa, namely the reasons for their threatened status, their habitat and biology. With a main character, a child with whom the children can identify with; secondary characters; an interesting environment; and a plot that includes a problem, a climax and its resolution (real and possible), this story teaches conservation issues and inspires youngsters towards marine biodiversity protection. Wittingly the main character is not a humanized seahorse, which makes the problem real and not an imaginary one. Two layers of information were included, one to listeners (4 to 6 y/o) using illustrations, other to readers (6 to 10 y/o). The main character, who presents himself as a change agent, creates an emotional bond, and leads the children to act in the same way to protect the seahorses. There is a strong and clear positive message and not a “moral lesson”.

This book is read by a marine educator, during the educational actions developed in schools, from the south of Portugal (where Ria Formosa lagoon is located). The storytelling is complemented by diverse hands-on activities that help to raise the knowledge about seahorses.

This original and innovative approach added value to the learning process, being more than cognitive, creating a higher emotional engagement, making the interpretation easier and the whole educational experience funnier and more attractive. Furthermore the use of the book, has the potential to amplify the action to the children’s family, as it is distributed freely to all participants.

Regarding the need to change behaviours towards a sustainable future for the ocean, it is of utmost importance to create a blue generation, empowered to be part of the solutions and with a voice in major environmental issues discussions.

Sea Change legacy: the « Ocean wellbeing » kit, a way to increase Ocean Literacy to the general public

Ms. chiroutré elise¹, Mr. Tristan Hatin¹

1. Nausicaa, National Sea Centre

Sea Change is a funded project that aimed to establish a fundamental “Sea Change” in the way European citizens view their relationship with the sea, by empowering them, as Ocean Literate citizens, to take direct and sustainable action towards a healthy ocean and seas, healthy communities and ultimately a healthy planet.

By using the concept of Ocean Literacy, Sea Change has created a deeper understanding amongst European citizens of how their health depends on the health of our seas and ocean. Sea Change brought about real actions using behavioural and social change methodologies.

As World Ocean Network 3rd party in this project, Nausicaa worked collaboratively with a group of many Hauts de France World Ocean Network partners to create a new educational activity: “Ocean wellbeing”. This initiative aims to raise citizens’ awareness of the benefits that we gain from the sea. Using a giant dice, the public, children and adults, pick an intergenerational game, out of 6 well known games, to explore and learn while having fun. These games show how the ocean is a source of food and medicine, leisure and well-being, and how it links human beings and lands, supplies oxygen, regulates the climate and participates in the water cycle. This educational tool is available online in English and French. All the material can be downloaded for free.

This tool is a good way of enhancing Ocean Literacy and putting forward citizenship of the Ocean, as it highlights the right to benefit from the Ocean’s resources, the duty to preserve and conserve it for the future generations.

<https://www.worldoceannetwork.org/won-part-6/active-3/sea-change-project/sea-change-ocean-wellbeing/>

Sea Synergy connecting people and the Ocean

*Ms. Lucy Hunt*¹

1. Volvo Ocean Race

Sea Synergy is an award winning Marine research & education centre specialising in educational workshops on marine biodiversity & conservation opened in July 2014 by marine biologist Lucy Hunt, with the support of EU Fisheries Local Area Group Funding. This unique marine education centre won the Irish Maritime Industry Awards for Marine Tourism & Leisure in 2017, awarded a Responsible Tourism Award for Natural Heritage in 2016 and nominated for Ocean Hero business and Irish Marine Tourism Award in 2015.

Sea Synergy also runs a Clean Coasts group who organise beach cleans with local community and raise awareness of plastic pollution through campaigns such as Plastic Free July and citizen science research on seals in Waterville and also raises awareness of other citizen science programmes such as Purse Search, Crab Watch and Coastwatch surveys with local community and holiday makers increasing marine outreach.

Sea Synergy initiated and organises Iveragh Learning Landscapes Symposium (funded by EPA & Heritage Council) – connecting people with Learning in the Outdoors. Learning Landscapes is aimed at educators to use the outdoors (including marine environment) as a classroom for cross curricular subjects, now in its third years, Learning Landscapes attracts over 200 attendants.

Sea Synergy has a multi-disciplinary team of marine educators, artists, designers, engineers and fishermen working together with a combined experience equal to 141 years in innovative sustainable coastal community development and community engagement and education.

Sea Synergy recently hosted HRH Prince Charles and Duchess of York Camilla in Co. Kerry to showcase the ocean literacy work they have been involved in and plastic pollution education and campaigns.

Shaping the Future, Conserving the Past of a Post-Industrial Seascape: ‘SeaScapes’ A Case Study of the UK’s First Seascape-scale Conservation Initiative

Mrs. Veronica Rudd¹, Ms. Emily Cunningham²

1. SeaScapes Partnership, 2. Marine Conservation Consultant

In a post-industrial seascape in North-East England, once the most polluted in Europe, poor perceptions of the marine environment pervade; resulting in seabird persecution, high levels of beach litter and a lack of engagement with conservation initiatives and the environment itself. This has severely limited our understanding of the marine environment and impacted our ability to effectively manage the seascape.

In 2016, local authorities, universities, NGOs and community groups working across natural-cultural-historical heritage came together to pool resources towards a collective vision for the seascape, its communities and its heritage. Together they developed “SeaScapes”, the UK’s first Seascape-scale conservation initiative.

SeaScapes focuses on the Magnesian Limestone coast between the Rivers Tyne and Tees in north east England. Whilst perceptions of the seascape are blighted by its industrial past, this seascape is bound in character by unique geology, the natural environment and a shared cultural heritage. There is much to be celebrated from rich maritime heritage to an internationally important seabird colony. Once covered in colliery spoil, major regeneration has also seen this seascape reinvigorated into life, with recent surveys documenting lobsters, soft corals and an abundance of fish. Much of this heritage is out of sight, held only in memory, beneath the waves just waiting to be discovered.

The scheme is currently in detailed development, bringing scientists, practitioners and citizens together to make marine science matter in conservation practice and leave a lasting legacy for the heritage, communities and wildlife of this seascape. Supported by the Heritage Lottery Fund and Partners, SeaScapes aims to deliver thirty interconnected projects, events and activities over four years; to conserve the natural environment and rich maritime heritage. Working collaboratively across multi-disciplines will ensure the natural, cultural and historical heritage of the seascape as a whole: to improve biological recordings through citizen science; tackle marine litter; create opportunities for local people and visitors to enjoy being on and in the sea.

Through restoring, connecting and creatively animating our heritage assets, whether on shore, underwater or remembered, this scheme aims to improve perceptions and ocean literacy and to inspire behavioural change amongst coastal communities and visitors.

Specialist Marine Education for Primary Student Teachers

***Dr. Thomas McCloughlin*¹, *Dr. Noirin Burke*², *Ms. Cushla Dromgool Regan*³**

1. Dublin City University, 2. Galway Atlantaquaria, 3. Marine Institute

Marine literacy is critical for teachers to allow children to consider the marine as a source of employment in a wide range of industries which otherwise they remain unaware of. Marine literacy is something that comes about through interpersonal exchange of experience, which in the past relied on grand-/parent-to-child transmission. However, nowadays, marine literacy must now be ‘taught’ or learned in ‘new ways’. It is hypothesised that children lack basic content knowledge as well as an integrated higher level understanding of humanity’s relationship with the marine. In addition to all teachers receiving a basic instruction in activities that can be implemented in primary schools, specialist training as leaders in marine education who will form a network of leaders to advise their colleagues on seeking out opportunities for learning about the marine and bringing the marine into the classroom. A case-study of three small scale samples of n=7, mean age= 19.4yrs, primary student teachers at Dublin City University were immersed in a science project to monitor the water quality and biota of Rogerstown Estuary (Special Area of Conservation / Natura 2000 site). Using a number of parameters, establishing a tidal mesocosm, sediment analysis provided a multi-pronged approach to bring awareness of life in the neglected spaces on the coast and challenge their perception as dead places. The students were interviewed to establish their learnings by engaging in the project and their perceptions as leaders in marine education were established. The resulting data was analysed using idiographic analysis, a toolbox of repertory grid analysis under the theoretical framework of personal construct psychology. We hypothesised that their perception of themselves as leaders in marine education was initially low, and as their understandings developed, so too their construct of themselves as leaders. It was found that an outdoors, immersion in scientific techniques coupled with laboratory analytical methods provided a deeper insight into marine ecology, life in estuaries but also of science in general.

The European Atlas of the Seas: A powerful learning tool to use in classrooms

Ms. Selene Alvarez¹, Ms. Andrée-anne Marsan¹

1. EMODnet

A revamped **European Atlas of the Seas (Atlas)** has been released, offering a wealth of easily accessible maps, new features and at-a-glance metrics on diverse marine topics such as nature, tourism, security, energy, passenger transport, sea bottom, sea level rise, fish consumption, and much more.

With this online tool, users are invited to explore and create their own marine and coastal maps. These maps can be printed, shared and embedded in presentations or articles.

In this oral presentation, we will illustrate how the Atlas can become a powerful learning tool in classrooms. Through a presentation of its functionalities and use cases, we will demonstrate how the Atlas can support the work of teachers in many courses. We also aim to get valuable feedback from experts in education in order to better meet their needs.

The Atlas includes a collection of maps and associated fact sheets based on data originating primarily from the European Commission and its agencies but also from other sources, including the European Marine Observation and Data Network (EMODnet). The project was initiated in 2008 by the European Commission, Directorate-General for Maritime Affairs and Fisheries (DG MARE), to raise awareness of Europe's oceans and seas, in the context of the EU's integrated maritime policy.

Currently available in four languages (EN, FR, DE & NL), the Atlas will soon be available in all official languages of the European Union.

The Impact of Residential Field Courses on ‘Ocean Literacy’ Awareness in UK post-16 School Students

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The Field Studies Council (FSC) is a UK environmental education charity, which runs 20 field study centres across the British Isles, catering for students from of all levels and backgrounds. Building on an earlier pilot study, 3 coastal FSC field centres, which deliver marine-based field courses, took part in a detailed evaluation study over the 2017 teaching season. Data was collated from over 900 16-18 year old students from 50 different schools. Their level of awareness of marine issues before and after a marine field course was assessed and their responses coded into cognitive/knowledge, affective/emotional and behaviour. A further assessment was carried out 3 months after the field courses. The results have been analysed to measure the impact of the field course on student ‘ocean literacy’ levels in the short and medium term. The differences in outcome have been compared depending on the experience levels of FSC staff, the type of school and the sex of the students. It also evaluates the impact of training designed to increase FSC staff awareness of ocean literacy above and beyond curriculum requirements. Many students show increased knowledge of marine issues through attending the field courses, but there was less evidence of any significant personal behaviour change. The way traditional school field courses are delivered in the UK with their emphasis on knowledge content and the tendency for students to see field courses as separate from their daily lives are discussed as important factors. It is recognised that a field course can only have a small impact on behaviour change and this study highlights the barriers to increased awareness and action as well as raising the profile of ocean literacy good practice.

The System Dynamics Approach to Teaching and Learning Ocean Literacy

Ms. Caroline Brennan¹, Dr. Owen Molloy¹

1. National University of Ireland Galway

The System Dynamics Approach to Teaching and Learning Ocean Literacy

Abstract

Leaders in the Ocean Literacy (OL) field have recommended taking a systems approach in order to deal with the complexity of the human-ocean relationship (NMEA, 2013 and Tran et al., 2010). They contend that the inclusion of modelling and simulation will improve the effectiveness of educational initiatives. We have so far found no examples in current use.

In this poster we will describe the design and development of a Simulation-Based Learning Environment (SBLE) using System Dynamics and a study to investigate its effectiveness for increasing Ocean Literacy. Through the identification and use of systems archetypes and general systems features such as feedback loops, we will also test for the instilling of transferrable skills and the ability to identify, apply or create sustainable solutions.

Research Objectives

Our team at NUIG is interested in incorporating a Systems approach to teaching Ocean Literacy in order to increase its effectiveness. The primary questions posed in this research can be summarised as follows:

- Does the inclusion of Systems Thinking and Systems Dynamics simulation improve acquisition of Ocean Literacy skills, in terms of deeper understanding, and greater retention?
- Does the teaching of Systems Constructs and Systems Archetypes in particular help learners to *transfer their systems knowledge* from one topic to another?
- Does the use of Systems Thinking and Systems Dynamics simulation in Ocean Literacy education increase the ability to recognise, create or apply *sustainable solutions*?

Design of the Study

We are currently designing a workshop centring on two key stories - Sustainable Coastal Development and Sustainable Fisheries. We will combine face-to-face teaching with a simulation-based learning environment developed at NUIG. The material for the training will be based on the Key Stories documented during the ResponSEable[1] EU project.

Methodology

For each key story, a set of Learning Objectives will be created, comprising the relevant OL knowledge, systems knowledge, and the knowledge required for identification of sustainable solutions.

Indicators (metrics) will be created for each of these, and they will be used to design tests to measure performance of the subjects before and after the training.

Evaluation

We will compare the effectiveness of a systems approach taken in an experimental group, with a non-systems approach taken in a control group by testing the knowledge of participants on the chosen themes before and after the teaching.

I will use the framework for measuring effectiveness of Ocean Literacy tools and teaching which is a key part of the ongoing research within our team for the EU ResponSEable project.

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[1] <http://responseable.eu/>

Vaivém Oceanário, an outreach educational project to promote ocean literacy

Mr. Tomas Santos ¹, Dr. Teresa Pina ¹

1. Oceanário de Lisboa

The Oceanário de Lisboa is a public aquarium, in Lisbon, Portugal with the mission of encouraging people to learn more about the ocean and make all citizens aware of their duty to conserve their natural heritage, by changing their behaviours. Raising awareness about ocean issues of the Portuguese population was, since 1998, an enormous challenge to Oceanário de Lisboa. To amplify the reach of the educational activities developed in the aquarium facilities and to spread its mission all over the country, an outreach environmental education project was created in 2005. To accomplish this purpose an easy, self-extensible van was settled, which includes an indoor space and an outdoor tent, where participants are invited, by marine educators, to get on-board to discover the ocean secrets, during 60 minutes chaperoned activities. Considered as the most ambitious social responsibility project of Oceanário de Lisboa, the Vaivém is open to all visitors, from schools (pre-K to high school), private and public social solidarity institutions, families and local communities. Regardless age, gender, origin, religion or level of education, everyone is welcomed in the project free activities. During the last 13 years, several subjects were explored in Vaivém Oceanário, such as the role of aquariums in nature conservation and promoting ocean literacy, the amazing life of the sea turtles by revealing their lifecycle and its biology, the proposal of extension of the Portuguese continental shelf presented in the new map “Portugal is sea”, which allowed to unravel the mysteries of the Portuguese marine species and ecosystems. In 2018 the outreach project set the goal to explore the ocean’s influence in our lives and how our daily activities impact the ocean health, claiming attention to nowadays ocean’s biggest problem: plastic pollution. This open window to ocean knowledge, has already visited 204 municipalities, during a 6-days long action, engaging more than 235.000 participants. The success of this outreach project is achieved through the partnerships between local authorities, schools and public and private institutions. The actions developed in the Azores and Madeira’s islands were the best examples of these partnerships, namely, the support of flight and shipping companies and local authorities. Oceanário de Lisboa aims to continue this project in order to contribute to create a Portuguese Blue Generation, which cares about the ocean and makes conscious and responsible decisions regarding the sustainable future of ocean.

WORKSHOP Aquabotz – Contagious, Experiential Learning by Building Inexpensive, Non-threatening, Underwater Robots

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The shortage of youth in the professional pipeline for Marine Industries is blamed on a lack of experiential programs that launch contagious interest in the sciences. Ocean Exploration identifies education and outreach as critical to entice students into the field. Education works best when the lesson topic is invisible, the delivery contagious, and the end result addictive. Head into a classroom and announce that you're going to be lecturing about circuits and electricity. At any age, this might result in a "snore-fest". Change the preamble to "today we'll be building underwater robots" and you'll see the students lean forward...

In this workshop participants are provided with components needed to build a working and tethered ROV. They will be taught how to deliver the "Aquabotz" program by being students.

"Aquabotz" was created in 2002 through a NASA/Academic partnership and grew through training with the Marine Advanced Technology Education Center (MATE) of Monterey Peninsula College. Student groups introduced to ROV's with this program have gone on to compete internationally in the MATE ROV competition. Over the years, the Aquabotz program has been delivered by Washington College from the 3rd grade (8-10 yrs) to adults. The Aquabotz can be designed, built and operated in about an hour. They are deployed off a dock or pool-side and can be tested, pulled out, dismantled, and modified to optimize the design. The challenge is to build a fully functional ROV capable of floating, sinking and moving into all directions.

Aquabotz Kit – Parts are readily available from hardware or hobby stores, or the Internet. There is no need for soldering. Aquabotz have printed circuit boards and screw on wire connectors. PVC pipes are used for the frame and bilge pump motors for thrust. Speaker wire transfers the power and control information from switches in a control box to the ROV. Three thrusters allow for all directional movements. A rheostat allows for varied vertical control for diving, surfacing and water column hovering. Buoyancy uses foam pool noodle pieces fastened to the frame with reusable plastic cable ties. The PVC frame holds together with friction. There is no glue. Aquabotz are safely powered by a 12v battery backpack carried by the operator.

In addition, an underwater video camera can be deployed on the ROV for observation. In an exemplary program students used nylon cloth to build Aquabotz with plankton catchers. Following deployment, the net contents were analyzed and sketched by the students.

Using ROV's as a platform for learning has many advantages. The Aquabotz program encourages interdisciplinary instruction. Their use supports the introduction of marine and non-marine related career paths. Subjects such as science, math, physics, technology, and art are delivered without students knowing it. Techniques for critical thinking, team building, sportsmanship, verbal and written communication skills are also delivered with this program. The program is hands-on and demonstrates value-added topics, such as, basic tool use, teamwork, electrical concepts, buoyancy, and propulsion.

Could MarineTraining.eu be the future single point of access for all levels of marine training and education?

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1. University of Ghent

The MarineTraining Portal (www.marinetraining.eu), supported by the EMBRC-ERIC, has since its establishment in 2013 evolved into the reference data portal for Marine Graduate training opportunities in Europe and abroad. The portal was extensively used for creating reliable background information for the recently published future science brief from the European Marine Board on “Training the 21st Century Marine Professional”.

Until now the comprehensive database focusses on higher education institutes (both universities and university colleges) and collects existing marine training initiatives for each country, ranging from master and doctoral programmes, to expert trainings and specialist courses. The platform is however expanding gradually by including also non-accredited training initiatives (for instance from research institutes and industries) and via involvement in other European projects and networks. Services in the Marine Training Platform include advertising possibilities, practical services to trainees and training organizers (application and registration) and the support of marine dedicated e-learning initiatives.

Recent discussions with for example UNESCO IOC and the European Commission highlighted that the Marine Training portal could in the near future also play an even more important role by expanding the offer and services on both a regional scale and on a content scale.

On a regional basis the MarineTraining portal will gradually also cover other areas via the setup of regional contact points. On a content level, marinetraining.eu wishes to expand the dataset with training initiatives and resources that are appealing to a wide range of end-users (eg. Marine professionals, teachers, students, public at large).

Reaching both goals will only be possible by joining forces with existing key organizations and projects.

MarineTraining.eu hopes to embrace the principle “Seas do not have boundaries, Education shouldn’t either”, and hopes to be an open platform helping trainees, training organizers and people looking for reliable insights in marine training and education.

For more information: www.marinetraining.eu

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