

EUROPEAN MARINE SCIENCE EDUCATORS ASSOCIATION CONFERENCE

28th September – 1st October 2015

CretAquarium, Heraklion, Crete

CONFERENCE HANDBOOK





CONTENTS

Welcome to Crete	1
Welcome to EMSEA15	2
Conference location and facilities	3
Horizon2020 Ocean Literacy Projects	4
Keynote Speaker – Pierre-Yves Cousteau	6
Programme Summary	7
What is Open Space?	8
Plenary Abstracts	9
Workshops	26
Poster Abstracts	30



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WELCOME TO CRETE

Crete is the largest of the Greek islands, one of the thirteen regions of Greece and the fifth largest island in the Mediterranean Sea. Heraklion, the capital, is the fifth largest city in Greece and home to the Palace of Knossos, a mazelike hilltop ruin, and the renowned Heraklion Archaeological Museum, housing Minoan artefacts from what is considered Europe's first great Bronze Age society.

Crete is renowned for its natural beauty and diverse landscape. Spectacular mountains are sliced by impressive gorges that spill out to the sea, infinite plateaus and fertile fields form its interior, while stunning endless beaches and isolated coves comprise its 1046 km coastline.

Due to its geographical position between Africa, Europe, and Asia Minor and due to its mild climate, Crete became a centre of culture as early as Neolithic times. The first prehistoric settlements appeared in Crete around 6000 BC while in 2600 BC settlers who knew how to craft bronze arrived in Crete. It was then that the illustrious course of the Minoan Civilization began, reaching its peak around 1950 BC with the erection of the imposing palaces in Knossos, Faistos, and Malia.

Crete's traditional villages, cultural heritage (dialect, drinks, dances, music, gastronomic culture), coupled with its significant history and the remains of Europe's most ancient civilization, the Minoan, are some of the reasons why Crete is one of the most popular tourist destinations in Europe.

A little bit of mythology...

Crete has a history, and prehistory, stretching back through centuries and millennia – its mythic history is every bit as old. Zeus – Father of Gods and Men was born here. It was also here he made love, secretly, to the beautiful maid *Europa*, from which we get the modern name for our continent.



WELCOME TO EMSEA15

Dear EMSEA15 delegates,

The Hellenic Centre for Marine Research (HCMR) and EMSEA are delighted to welcome you on the spectacular Greek island of Crete for the 3rd European Marine Science Educators Association Conference.

We are very grateful that you travelled all the way to the Mediterranean Sea for this gathering. Each one of you makes a unique contribution to this conference. And together we speed the transition to a more ocean literate society.

The EMSEA conference is a remarkable forum for all marine scientists, marine science educators, teachers and ocean policymakers, from across Europe and around the world. Once a year EMSEA conferences provide a platform for exchanging successful practices and experiences, for discussions, as well as for meeting new colleagues and reuniting with old friends. This sense of community and common purpose provides a major foundation for increasing the level of our collaboration and collective impact. As the EMSEA network grows, so do long term connections between all who participate.

This year, we have a very special keynote speaker – Pierre-Yves Cousteau – along with excellent talks from our colleagues in 12 European countries, the USA and Brazil about best practices for promoting ocean literacy, and evaluation findings from some fascinating programs.

As many attendees suggested at EMSEA14, we are allocating more time for discussions. During the conference, attendees will be invited to suggest topics for an Open Space session, an innovative format where attendees gather in small groups to share their thoughts about the most important issues raised at the conference!

Workshops were such a success at last year's conference, we decided to make them longer this year! Participants will select between four engaging workshops:

- a speed course in marine science communication,
- a workshop about how to embed ocean literacy in the core curriculum for 5-14 year olds,
- a demonstration on the beach of a mobile app addressing marine litter,
- a workshop about how to use storytelling to encourage engagement in ocean science.

We have also organized some social events for each evening of the conference that we hope you will enjoy and some special field trips planned for the end of the conference.

We look forward to a fruitful and stimulating conference, and moreover wish you a wonderful stay in Crete.

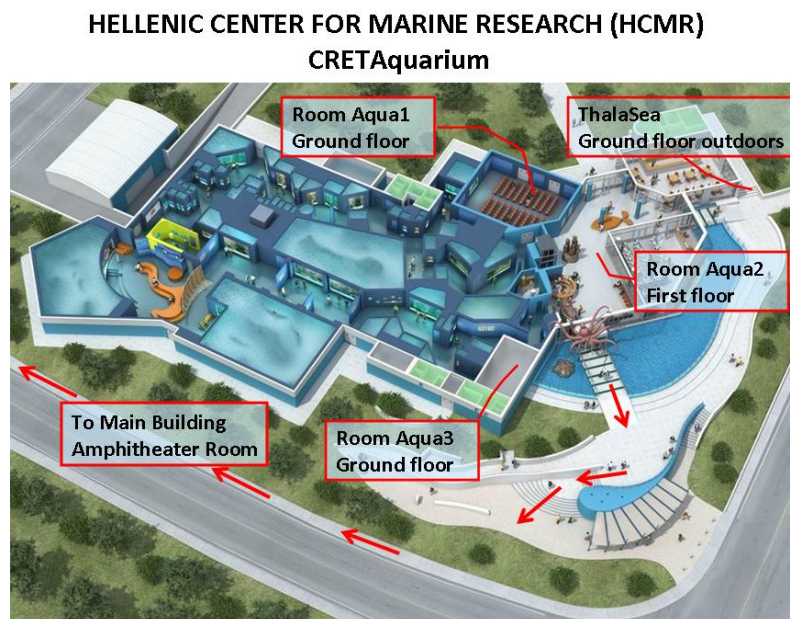
Martha Papathanassiou
On behalf of the EMSEA15 Organising Committee.

CONFERENCE LOCATION and FACILITIES

The conference will be held at the CretAquarium and the HCMR facilities. The two buildings are less than a 2-minute walk away from each other as you can see in the map below.



The CretAquarium complex is found at the area of the former American Base in Gournes, 14km from the city of Heraklion and the International Airport *Nikos Kazantzakis*. It is easily accessible and the national road connects it with the most important destinations of the area.



Horizon 2020 Ocean Literacy Projects

Sea Change

Sea Change aims 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 will create a deeper understanding amongst European citizens of how their health depends on the health of our seas and ocean. Sea Change will move to bring about real actions using behavioural and social change methodologies. Building upon the latest social research on citizen and stakeholder attitudes, perceptions and values, the Sea Change partnership will design and implement mobilisation activities focused on education, community, governance actors and directly targeted at citizens. These actions will be assessed for their effectiveness which, in turn, will allow the project to improve its techniques and spread a “Sea Change” in behaviour across Europe.



The Sea Change consortium consists of 17 partners from nine different countries, coordinated by the Marine Biological Association of the United Kingdom.

Sea Change also has an International Advisory Group (IAG) which is an independent body consisting of selected high level experts drawn from a range of stakeholder communities, who have knowledge

and experience of Ocean Literacy and scientific public engagement. These Key US, Canadian and EU external parties stakeholders will share knowledge, provide guidance and feedback to the work package structures within Sea Change throughout the course of the project.

Key objectives of Sea Change are to:

- Compile an in-depth review of the links between Seas and Ocean and Human health based on latest research knowledge outputs
- Build upon the latest social research on citizen and stakeholder attitudes, perceptions and values to help design and implement successful mobilisation activities focused on education, community, governance actors and directly targeted at citizens. marine education
- Build upon significant work to date, adopting best practice and embedding Ocean Literacy across established strategic initiatives and networks in order to help maximise impact and ensure sustainability
- Ensure that efforts to sustain an Ocean Literate society in Europe continue beyond the life of Sea Change through codes of good practice, public campaigns and other ongoing community activities.

- Ensure that all activities of Sea Change are carefully monitored and evaluated to ensure maximum sustainability, effectiveness and efficiency
- Ensure Knowledge exchange with transatlantic partners to bring about a global approach to protecting the planet's shared seas and ocean.



This project has received funding from the European Union's Horizon 2020 Framework Programme for Research and Innovation (H2020-BG-2014-1) under grant agreement No. 652644. This publication/multimedia product/presentation reflects the views of the author, and the European Union cannot be held responsible for any use which might be made of the information contained therein.

ResponSEable

World Ocean covers more than 72% of the planet surface. However, despite the increasing knowledge and efforts in ocean literacy, raising awareness and ensuring changes in behaviour remains a challenge. The available knowledge does not sufficiently describe the organisation of the market economy that is connected to the ocean (both in terms of sectors benefiting from sea products and sectors impacting directly or indirectly on the health of the ocean). There has been poor success in sharing this knowledge and raising awareness on “who” and “how” to act: thus, who might best have the possibility to adapt its practice and change its behaviour remains unclear.



ResponSEable aims at supporting the emergence of an effective and dynamic European ocean knowledge system that contributes to raising awareness on everybody's (individual and collective, direct and indirect) responsibility and interest in a healthy and sustainable ocean.

The ResponSEable project will combine knowledge from all compartments of the ocean and value chain, making connections between a diversity of knowledge produced and will directly contribute to the sharing of (relevant) knowledge produced with societal stakeholders and the wider public – via the development of communication material/products. It will put in place a sound testing and monitoring/evaluation process of the communication products developed and build in particular on real-life testing and the Living Lab concepts, it will enhance the effectiveness of these products so behavioural changes take place in the medium to long term.

The project will have strong regional focus: the Mediterranean, the Baltic, the North Sea and the Black Seas as well as the Atlantic – putting emphasis on the transatlantic shared responsibility and interest between Europe, The United States and Canada to contribute to the fulfillment of the Galway Statement.



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 652643

KEYNOTE SPEAKER

Pierre-Yves Cousteau

Pierre-Yves is the youngest son of Jacques-Yves Cousteau. Having studied biochemistry, space science and business administration (all at masters level), Pierre-Yves is constantly working to find innovative solutions for sustainable development, specifically for the protection of marine ecosystems, which are the foundations that support human survival and well-being. Pierre-Yves launched Cousteau Divers in 2009, a citizen science initiative to unite recreational divers for the study and protection of marine life. In addition to collecting diver's observations, Cousteau Divers has initiated a pilot project for community-management of a marine protected area in Santorini, Greece: a novel approach to marine conservation involving all local stakeholders. In 2013, he launched the Turbosail startup, commercialising a revolutionary invention of his father that has the potential to reduce the fuel consumption of large cargo ships by 15%, consequently reducing their CO2 and sulfur emissions. This hybrid wind propulsion project has been stalled by the recent drop in oil prices, which has temporarily impacted the economic viability of the entire clean-tech industry. The Cousteau Society, of which Pierre-Yves is a board member, remains active in bringing this technology to market. Today, Pierre-Yves works for the International Union for the Conservation of Nature as a marine program officer, specifically on the Sea for Society project to foster environmental stewardship values within European cultures, on the Catlin Sea View project to map coral reefs worldwide, and in developing strategies for Blue Growth, combining finance and conservation. An avid scuba diver and underwater photographer, he is always eager to return to the sea to be reminded of its beauty and importance.



PROGRAMME SUMMARY

Monday 28th September		
09:00 – 12:00	Registration	CretAquarium
12:30 – 16:30	Opening Session	HCMR Amphitheatre
17:30	Aquarium tour	CretAquarium
18:30	Ice Breaker Reception Dinner	Roof Top Terrace
Tuesday 29th September		
08:00 – 09:00	Registration	CretAquarium
09:00 – 11:40	Plenary session	
12:00 – 13:00	Workshops	
13:00 – 14:00	Lunch and poster presentations	
14:00 – 14:45	Open Space topic selection	
15:00 – 17:00	Open Space discussion	
18:30 – 22:00	Conference dinner	Meet @ CretAquarium
Wednesday 30th September		
08:00 – 09:00	Registration	CretAquarium
09:00 – 11:40	Plenary session	
12:00 – 13:00	Workshops	
14:30 – 16:00	EMSEA – the way forward	HCMR Amphitheatre
16:30 – 17:15	General discussion and concluding remarks	
17:30	Conference close	
18:00	Aquarium Bingo	CretAquarium
Thursday 1st October		
10:00 – 15:00	Wild Beach Schools workshop	
	Fieldtrips	

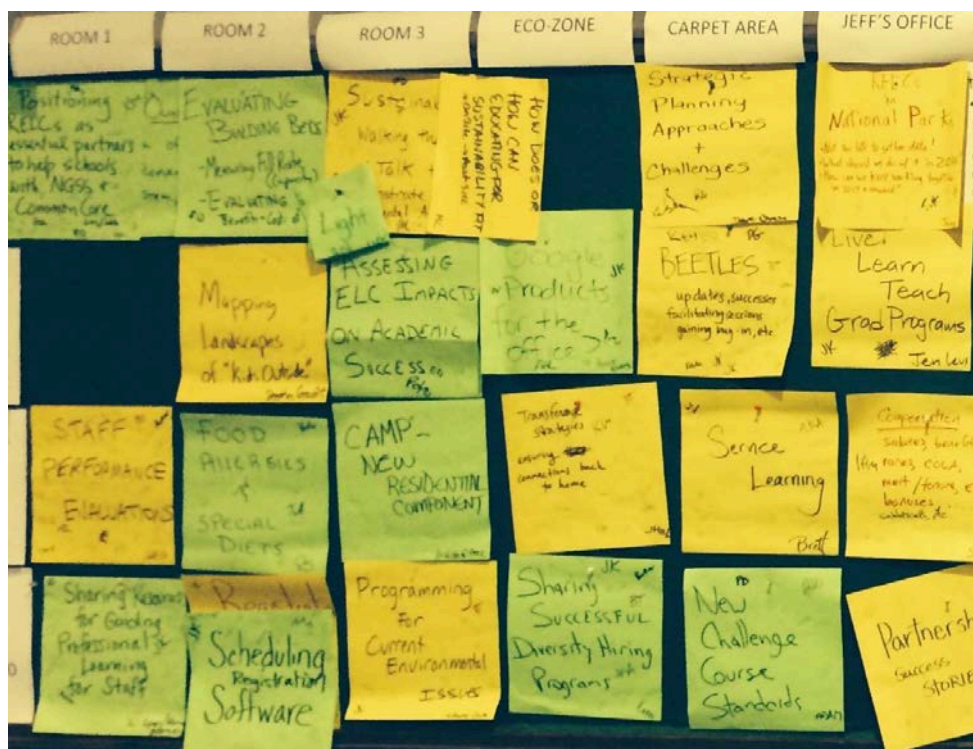
The programme is also available on SCHED www.emsea2015.sched.org

WHAT IS OPEN SPACE?

Many of us have the experience of attending conferences that have programs, speakers and sessions that were carefully and thoughtfully planned months or even years in advance. Despite the best planning and the presence of the most engaging speakers possible, we often leave conferences feeling that our most important and productive experiences occurred during the coffee breaks, in the hallways between sessions, or even when a handful of colleagues skipped a session to continue an important discussion that began over coffee.

Open Space is an ingenious, creative, loosely structured strategy for setting aside time to have important, authentic and spontaneous discussions about topics and issues of our own immediate choosing. At EMSEA 2015, all participants will have the opportunity during the conference to propose and then facilitate discussions about topics that are immediately relevant. We will set aside two 90-minute blocks for parallel sessions during which participants can attend any of the proposed discussions. The person who proposed each discussion will briefly introduce the topic, and everyone attending will share in an open and spirited discussion. If you have never participated in Open Space before, you may be skeptical that it can work, but if you have participated in Open Space, you know it will be the highlight of the conference! We know there are things you want to talk about and problems you need to solve. Open Space will give you the chance to freely share ideas with some of the most effective leaders of ocean literacy from throughout Europe.

Craig Strang - Associate Director, Lawrence Hall of Science



PLENARY ABSTRACTS

Tuesday 29th September

Session 1a Ocean Literacy: Evaluation of Action and Measured Impact

How does participation in Educational Outreach Benefit Scientists?

Dorph, R, Chung, J., & Cannady, M. A.
The University of California, Berkeley, USA

For almost a decade, scientists and educators have been collaborating on several education and public outreach initiatives as part of the Centers for Ocean Sciences Education Excellence (COSEE). While the goals and strategies of the COSEE are multi-faceted, during this session we will share results from research conducted to learn about the impact of these collaborations on scientists. Study data collection includes interviews of 14 scientists designed to support the development of a scientist survey that served as the main data collection method for this study. The final scientist survey was sent to 1,841 COSEE-involved scientists. With a response rate of 41%, we analyzed 767 completed surveys. Analysis of survey and interview data revealed several direct benefits to scientists: (1) support for accessing research funding through help in developing broader impact and EPO (education and public outreach) statements; (2) opportunities for the scientists and their graduate students to engage in education and outreach; (3) personal fulfillment and enjoyment of engaging in education and outreach; (4) change in attitudes about teaching, learning, and the role that public understanding of science plays can play in society; (5) change in their own teaching practice; (6) change in thinking about their scientific pursuits; (7) increased demand and support for science research funding through public understanding; and (8) developing more institutional support for scientist participation in education and public outreach. This study shows there is an intensity and duration of engagement needed in order to witness the types of transformative outcomes we observed among a subset of survey respondents. It suggests that substantial investment is required to meet to transform relationships between scientists and educators.

The Ocean Literacy Principles – Understanding the impact of Educator-Scientist collaboration on public understanding of science.

Chung J., Dorph R., & Cannady M.A.
The University of California, Berkeley, USA

This presentation explores efforts to measure the impact of the Ocean Literacy Principles and the related materials that have resulted from educator-scientist collaborations led by the Center for Ocean Sciences Education Excellence—California (COSEE—CA). More specifically, COSEE—CA researchers have developed a survey that measures understanding and attitudes about the ocean and the role that ocean sciences play in supporting understanding of Earth systems by asking questions related to 4 dimensions of Ocean Literacy: knowledge, attitudes, behaviors, and exposure. The instrument was developed with the goal of yielding a tool that is easy to administer and analyze so that it will have maximum utility and flexibility. This measurement tool supports formative efforts (e.g. guiding the kinds of interventions used for targeted audience) and summative evaluation (e.g. measuring the impact of educational outreach efforts). This presentation draws on survey responses collected from an interstate sample of 232 participants through an online link. This presentation describes what we have learned to date through the developing and administering this instrument: while a substantial number of items were rejected from the knowledge scale, the resulting four item set showed relatively good model fit; the attitudes scale lacked sufficiently difficult items to correspond to the relatively high scoring sample; and a strong relationship between *attitudes* and *behaviors* was evident, as compared to the weak relationship between *knowledge* and both of these constructs. The presentation also discusses next steps for improving the quality of this instrument that include: increasing the difficulty of several of the items and testing it on a more diverse sample of respondents. Finally, this presentation will highlight the potential uses for the instrument across the COSEE Network and beyond to measure impact of education and outreach efforts on the ocean literacy of target audiences.

Training a generation of engaged marine scientists

Miller, A.H.A.¹, Crabb, A.¹, MacKinnon, R.¹, McNeill, H.¹
¹*Scottish Association for Marine Science, UK*

The times of the academic ivory tower may be over but the scientists emerging from it often lack both commitment and skills to practice effective public engagement.

Many universities have offered some media training for postgraduate students and early career researchers, but other forms of communication are rarely taught as part of science degrees.

A decade ago the Scottish Association for Marine Science (SAMS) introduced an optional module in ‘Science Communication’ for students studying the BSc (Hons) Marine Science at the University of the Highlands and Islands. The popular module aims to equip honours year students with a communications tool box and provides them with opportunities to practice in the real world. Students learn to clearly articulate key messages and to consider their

audience needs before designing communication activities for them – from posters, articles, maps, photos and school workshops to film clips, media interviews and debates.

The presentation will summarise the content of the module including the assessment challenges and will reflect on the very detailed feedback gathered through student learning diaries. Finally it will look at the career feedback from past students to assess whether it actually made a difference.

Regional and global cooperation for modern ocean literacy promotion: example from the Baltic.

Niedoszytko G.¹, Podlesińska W.¹
¹*NMFRI Gdynia Aquarium*

Promoting ocean literacy principles requires cooperation and joining forces among the institutions and specialists in the field of marine science. According to the philosophy "think globally, act locally" NMFRI Gdynia Aquarium organized Baltic Sea Protection Day. The event has been set up thanks to the international cooperation of South Baltic aquariums, maritime museums and universities that cooperate in the BalticMuseums 2.0 Plus project.

The BSP Day gathered experts in archaeology, diving, travelling, marine biology and oceanography as well as wide audience of people willing to gain the knowledge. To reach wider publicity, interviews with above mentioned representatives were recorded and shared via Youtube (www.youtube.com/AkwariumGdynskie) with social media community. Although it was an indoor, free of charge event, additional attention was attracted with outdoor photo exhibition documenting marine life of the Baltic. For mobile devices' users, more information on the Baltic biota components was provided with additional pieces of audio-recordings linked to the QR codes on the posters.

We know that the best way of transferring the knowledge is involving recipients. According to that principle access to special laboratories, educational games and demonstrations were granted to the participants. These attractions were designed to fit preferences and capacity of all age groups. The idea of those activities was to educate through entertainment. As a result, over one thousand people visited the event.

The Baltic Sea Protection Day was organized in the framework of the project Baltic Museums 2.0 Plus and part-financed by the European Union (European Regional Development Fund).

Using children's drawings and 'Generic Learning Outcomes' as tools to evaluate learning at the National Marine Aquarium

Murray N.¹

¹*National Marine Aquarium, UK*

The National Marine Aquarium is the foremost public aquarium in the UK with a dedication to education in the broadest sense. Established as a charity in 1991 and opening to the public in 1998, the Aquarium works to a mission to "Drive marine conservation through engagement". Learning is seen as being the heart of the organisation; it is the primary reason for the Aquarium's existence and is a main driver in activity.

Evaluation of our schools programme has evolved over the years from satisfaction based teacher surveys, to the current method of coding school student statements to assess them for Generic Learning Outcomes (GLO). These GLOs can give a picture of the knowledge, skills and attitudes that a student has gained from a visit and when collated over the year, gives an impression of how the schools programme has performed with regards to delivering its mission statement.

This presentation will also look at how the Aquarium used pre-visit and post-visit drawings as another tool to gain insight into how a visit to an Aquarium may impact on learning and thus advance Ocean Literacy.

[Caine, J. Bowker, R. Humphrey, L & Murray, N. (2012) Assessing informal learning in an aquarium using pre and post visit drawings *Educational Research and Evaluation: An International Journal of Theory and Practice*, 18:3, 265-281]

Connecting a wide audience with nature; an ethnographic evaluation of the Environmental Education Centre at the Two Oceans Aquarium, Cape Town.

van Gemert M.^{1,2} & Klaassen P.¹

¹*VU University, the Netherlands*

²*University of Amsterdam, the Netherlands*

The success of educational programmes can be evaluated by two means: 1) measuring the impact on the visitors, or 2) investigating how and to what extent the espoused mission (what they want) becomes manifest in the enacted educational efforts (what they do). The second aspect is the objective of this study, conducted as a 5-month ethnographic study of the Environmental Education Centre (EEC) at the Two Oceans Aquarium in Cape Town. The focus of this study were both the aquarium-wide mission (*To inspire action for the future well-being of our oceans*) and the EEC's own mission (*Connecting a wide audience with nature*). To achieve these missions, the EEC organises lessons for visiting school groups, enrichment courses for enthusiastic children and they run an outreach programme.

My observations and interviews pointed out that the EEC aims to entertain (experiential learning) as well as educate (knowledge). Every lesson and course has an environmental message; some courses even include compulsory environmental actions. The starting point for most of their lessons is touching – or experiencing – live animals, which determines the

knowledge content. This knowledge content plays a big role throughout many discussions and the focus of the EEC. For example, contrary to the lessons, knowledge is the starting point for the courses with some added activities. Indeed, in many occasions the teachers want to bring across so much information that they are constantly pushed for time and skip or shorten an activity. Moreover, the quality and success of the courses is judged based on pre- and post- knowledge tests.

From this study it seems that the EEC is doing rather well at letting children connect with nature (touching of animals) and inspiring them for action (environmental message and action). However, their disproportionate focus on transmitting knowledge might hinder fully achieving this mission.

Session 1b The Way Forward: Innovative Methods of Promoting Ocean Literacy

15 years of ocean literacy, from geography to ocean science, from the USA to Europe and beyond, where and how should we go in the next 15 years?

Tuddenham, P.¹

¹*College of Exploration, and the website oceanliteracy.net USA and UK*

In 2000 the USA a number of geographers, scientists and educators began discussing ways to add the ocean into the K-12 curriculum in the USA. From 2000-2005 a number of collaborative design actions occurred blending online and in person meetings, workshops and conferences. The output of those meetings was a guide that described a definition of ocean literacy, 7 fundamental ocean science principles and 44 essential concepts. From 2005 to 2010 the ocean literacy campaign in the USA grew to develop a scope and sequence for ocean literacy in K-12 schools.

The work in the USA began to attract international attention. From 2007 the International Pacific Marine Educators Network holds a conference every two years around the Pacific. These have occurred in Honolulu (2007) Australia (2008) Fiji (2010) Chile (2012) and Japan (2014). In 2010 three marine educators from Europe learned of the ocean literacy activities in the USA and started a conversation in Europe that led to the first conference on Ocean Literacy in Europe in Bruges 2012.

The Galway Statement on Transatlantic Ocean Science Research (2013), the EU Horizon 2020 Ocean Literacy grants (2014-15), and the first conference on ocean literacy in Canada (2015) are testimony on the growing interest and action on ocean literacy around the world.

What is the way forward for the next 15 years? The whole world needs to be involved in the evolution of the meaning of ocean literacy. The principles and concepts and learning progressions need to be reviewed and expanded to incorporate a holistic inclusion of all disciplines, cultures, knowledge from the east, the west and traditional sources. This expanded conversation is the work of the next 15 years. This session will review the history to date, and encourage participants to help shape the future directions.

Perceptions of Ocean Literacy: Interpreting Mental Models of the Ocean

Payne, D. L.¹ & Marrero, M.E.²

¹University of Connecticut–Connecticut Sea Grant, Groton, CT USA

²Mercy College, Dobbs Ferry, NY USA

How can we assess ocean literacy across ages, continents, political boundaries and language barriers? This process is critical in determining the impact of global work fostering ocean literacy. The use of peoples' illustrations or drawings is a common but sometimes controversial method of exemplifying a personal mental model representing knowledge and beliefs about a topic. According to Norman (2014), "Mental models are what people really have in their heads, and what guides their use of things," (p. 12). Mental models in turn can affect problem-solving and behavior (Gentner & Stevens, 2014; Johnson-Laird, 2001), and understanding individuals' mental models can help predict and explain behavior (Norman, 2014). In this presentation we will share results in the development of the Draw the Ocean instrument. Based in part on research results of the Draw-A-Scientist test (Chambers, 1983; Finson et. al, 1995; Hillman et. al, 2015) and the Draw-An-Environment test (Moseley et. al, 2010; Wee, Harbor, & Shepardson, 2006), Draw the Ocean consists of both a drawing prompt and a writing prompt to alleviate previous issues of validity and reliability with only a drawing prompt. The Draw the Ocean instrument was administered to adult professionals in ocean science and ocean science education. Both the drawings and written responses were analyzed via open coding to determine broad themes and then grouped into smaller clusters through axial coding. Drawings and written responses were also correlated to the Ocean Literacy Essential Principles and Fundamental Concepts, with the majority of categories falling under Principle 6. Preliminary results indicate discrepancies between participants' drawings and written responses as noted in recent iterations of similar research (e.g., Hillman et. al, 2015). We are currently seeking global partners interested in continuing research on the effectiveness and limitations of the Draw the Ocean instrument across age groups and in a variety of settings.

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On board everyone!

Rui Carvalho¹, Carla Albernaz², Ana Mira Vaz³

¹teacher, Colégio Pedro Arrupe, Portugal,

²teacher, Colégio Pedro Arrupe, Portugal

³Head teacher, Colégio Pedro Arrupe, Portugal

Colégio Pedro Arrupe (CPA) elects the sea as the symbolic reference of its project as its students learn to discover, respect and love the sea, in all its dimensions. CPA is located near the River Tagus, in the area where Expo'98 took place with the theme "The Oceans, a heritage for the future".

The school architecture reflects the Sea: the buildings on the ground floor are made of glass, symbolizing the water. All the other floors, made of pure cork, represent the continents explored and mapped by the Portuguese navigators in the 15th century. This great discovery allowed a cultural exchange among the civilizations of the world, as it is a characteristic of our pedagogy, inherited from Saint Ignatius, the first Jesuit.

Based on the seven principles of Ocean Literacy, we identified the essential contents and competences in the curriculum of the main learning areas. This work has been done by the teachers and taken from the curriculums of Pre-School Education (Children aged 3, 4 and 5) up to Secondary level (16 to 18 years old).

Thus, the school promotes an annual Sea Week, allowing students to work on environmental, humanistic and scientific projects, contact with investigators, visit ships and participating in contests. The CPA also promotes laboratory activities, workshops with experts/clubs (Sea Cadets), arts and crafts, plays and other events, themed outings and nautical sports.

This year, the *Maritime Action Plan* issued by the European Union proposes a coordinated work and communication among all the member states in the development of a *Blue Economy*. For every educational centre, it represents the challenge of becoming a *Blue School*.

On board everyone!

My school voyages with Perseus and Andromeda in Mediterranean Sea

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³ Faculty of Geology, University of Patras

The international environmental education thematic school network, "My school voyages with PERSEUS", offers scientific and pedagogical support to the schools belonging to it, as well as organises educational scientific expeditions.

More specifically, two oceanographic expeditions -ANDROMEDA I and II- were organized by the network with a duration of four days in March 2014 and in May 2015, respectively. At HCMR laboratories and at Cretaquarium "Thalassokosmos" students through experimental activities, gained knowledge and skills on measurements and sampling techniques used in the marine environment under real experimental conditions. Expedition ANDROMEDA I run in Saronikos Gulf, on the R/V AEGAEO and ANDROMEDA II in Cretan Sea on the R/V PHILIA. The aim of both expeditions was to involve students in marine scientific research and guide them to recognise the 'value' of the Mediterranean Sea and the associated threats, pressures and challenges upon it. The group of 30 students and 15 educators supported by 12 mentors-marine scientists and pedagogical counsellors created a powerful interactive learning experience, by participating in experiments, interpreting research findings and drawing conclusions. Paradigms will be shown during the presentation.

It's being a fantastic experience for all, more importantly for the "young oceanographers" not only by adopting the theory and the processes made but expanding their views through the report of their major expedition inputs and addressing future challenges. The successful interaction of students and scientists, in a mentor-student form, but also within the different groups they formed, shows that this approach assisted all, including the teachers, to act and work together for a common interest.

A connection with the other countries is expected to happen until the end of the project as students will exchange views and ideas through the "Clean Seas Ambassadors" network organised by PERSEUS project in December 2015 at the European Parliament.

From the Sea Curriculum to the Blue School

Pinto, P.

Pedagogical Board of Colégio Euro-Atlântico, Porto, Portugal

In 2012, the Colégio Euro-Atlântico has decided to create a *sea curriculum* based on the work made by Ciência Viva, *Conhecer o Oceano* (which has in turn been based on the US *Ocean Literacy* program). A set of skills related to life in the oceans was progressively introduced in the various curricular subjects and in the extra-curricular activities. The development of this theme was intended to involve the whole school community. Promoting work meetings with sea related institutions and professionals and engaged all the school community in the process, we proposed a **Blue School** Program built on three thematic axes:

I - Know the Ocean; II - Ocean and Globalization; III – Experience the Sea

Axis I, following the ocean literacy Portuguese principles, aimed at all levels of education, complemented by the participation of students in ocean contests and ocean projects, in partnership with promoting ocean literacy organizations. Included is the development and implementation of new protocols with maritime organizations and the Portuguese Navy.

Axis II, focusing not only on the importance of the oceans as a security factor and for the creation of wealth and power, but also on the commitments with the international community in the fields of both Search and Rescue and Control and Inspection. Maps of the Atlantic region and the world, which visually support the activities, are being prepared, as well as study visits to the Navy, namely COMAR.

Axis III, signing agreements with swimming, sailing, surfing, canoeing and rowing clubs with the practice of these modalities by students as our goal. It also predicts boarding nautical and naval vessels and use of the navigation simulation and command rooms.

In addition, we seek to establish direct contact between the students and the "seafarers", the people with marine life who speak from personal experience.

Educating teachers for ocean literate society – starting Ocean Literacy in Croatia

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²*Department of Pedagogy, University of Zadar, Croatia*

Croatia is a country with over 6000 km of coast, and marine surface of more than 31000 km². This data indicates Croatia's strong connection to the sea. Adriatic sea is of a priceless value to Croatia and its citizens which are strongly oriented towards the sea mostly through tourism and fisheries. While living in the times of great coastal pressure, climate change, ocean acidification, low carbon economy etc., there is a need to bring the knowledge about the ocean-human relationship to the citizens, with the emphasis on children, to better understand the changes in the nature, the bond between ocean's health and human health and the environmental changes that affect human population.

At the University of Zadar there is an initiative to start the program of marine science education of preschool and school teachers based on the ocean literacy principles. This program would qualify and train teachers to follow ocean literacy principles and to apply those principles through their teaching. Also, the program would enhance teachers' professional development. Ocean literate teachers would be able to transfer the knowledge about the sea to their students and make them more ocean literate. The idea of this educational program is to educate teachers through different subject courses and to elaborate the activities which they would use in everyday work (experiments, demonstrations, etc.). These activities aim to induce curiosity among children, to motivate and encourage them to ask questions about the environment and answer them by using scientific methods. Additionally, the teachers would have a chance to connect with the natural science community and perceive marine biology research by connecting with the University marine biology scientists group.

The goal of this educational program is to give the ocean knowledge to our preschool and school teachers who will forward that knowledge to younger generations.

Wednesday 30th September

Session 2a Ocean Literacy: Evaluation of Action and Measured Impact

Professional Development Program Evaluation: A comprehensive endeavor executed by the NOAA Office of Ocean Exploration and Research and Bridgewater Education Consulting

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²Bridgewater Education Consulting, U.S.

The U.S. National Oceanic and Atmospheric Administration's (NOAA's) Office of Ocean Exploration and Research (OER) began offering The NOAA Ship *Okeanos Explorer* Education Materials Collection: *Why Do We Explore?* professional development offerings (PDOs) in the spring of 2011 and *How Do We Explore?* PDOs in the fall of 2012. *Why Do We Explore?* targets modern reasons for ocean exploration including climate change, energy, ocean health and human health. *How Do We Explore?* targets the technologies of modern ocean exploration including multibeam sonar, water chemistry sensors, remotely operated vehicles and telepresence.

These day-long workshops are offered in coordination with 15 informal education partner institutions (e.g., science centers, aquariums, museums) across the country and are conducted by five-seven trained education facilitators. During the 2013-2014 and 2014-2015 academic years they became part of a series of two workshops – *Why Do We Explore?* and *How Do We Explore?*, modeled after a highly effective two-part series offered by OER from 2003-2009.

The development of a formal measure of public ocean literacy knowledge

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¹University of the West of England, UK

Within recent years, the UK has increased its engagement with the ocean literacy campaign and a range of projects have been delivered to highlight the public's connection to the ocean.

Although this range of engagement activities exists for the public, there is currently no formal evaluation in place to measure the current or future ocean literacy of citizens. This lack of evaluation means that it is not possible to state whether the ocean literacy of the population has changed or to highlight areas that engagement needs to focus on to improve overall understanding.

This ongoing MSc Science Communication project has aimed to develop, validate and test a survey that will measure the UK public's ocean literacy knowledge. A multiple-choice survey has been created which links to the 'ocean literacy principles' and 'scope and sequence'. The validity of the survey has developed through a series of stages including consultancy with a

range of ocean science and education experts, along with a public trial looking to develop the survey questions.

Although undertaking a full survey of the UK's ocean literacy is outside the scope of this project, an initial survey has been conducted to develop a baseline of questions for the potential use in future research. Analysis is currently being conducted, with the project finishing in early November 2015.

Ocean Literacy in Italian high schools. Where do we stand?

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¹*Underwater Bio-Cartography (Ubica), Genoa Italy*

²*Department of Economics, Management and Statistics-University of Palermo*

³*Studio Associato Gaia, Genoa Italy*

⁴*Università Politecnica delle Marche, Ancona Italy*

The Italian school system is undergoing a thorough revision both in terms of organisation and *curricula*. In line with this, the Ministry of Instruction and Ministry of the Environment recently jointly mandated that “the environment” be included in teaching plans– clearly opening the door to Ocean Literacy (OL). To such an aim, and within the broader scope of the Horizon 2020 Green Bubbles project, a first step is to gauge whether OL is already present in Italian high schools, to what an extent and, based on expressed and/or identified needs, how to provide guidance and supporting tools. This is being done at three levels:

- 1) Teachers, based on interviews of a stratified sample (teachers of science and of humanities from the northern, central and southern areas of Italy; 4 cities per area – 2 coastal and 2 land-locked; 3 schools per city, targeting science-oriented high-schools*). Focus: perceptions, attitudes and needs towards OL in teaching plans.
- 2) *Curricula*, analysed to: identify topics related to OL, "weight" them compared to other topics and quantify the overall degree of interdisciplinarity.
- 3) Students, evaluating their OL at the end of the 5-y school programme. This will be measured as the distance from the 7 OL principles by a dichotomous multi-items scale (true/false), where there are only one true statement based on the principles (or subprinciples) and three false statements.

The above will also highlight differences and commonalities in the attitudes and perceptions of teachers and students across Italy, and capture the difference between technical (science-based) vs. colloquial (culture-based) use of language.

* Italian high-schools are categorised based on the focal disciplines taught.

Green Bubbles has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant agreement No 643712.

Investigating the cross-cultural validity of the SOLE: Evidence from high-school students in Greece and the U.S.A.

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¹*Democritus University of Thrace, Alexandroupolis, Greece*

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Measurement of individuals' knowledge about ocean sciences issues requires tools that are aligned with the Essential Principles and the Fundamental Concepts of ocean literacy and possess well-established psychometric properties. Considering the lack of comprehensive instruments and the increasing demand for standardized tools that also allow for cross-cultural comparisons, the present study investigated the cross-cultural validity of a modified version of the SOLE scale, developed by Greely in 2008, in U.S. and Greek high-school students, using a Rasch analysis framework. The Rasch measurement model was used to generate item-fit statistics, assess item appropriateness and identify the item-difficulty hierarchy. The questionnaire was found to be a reliable and valid tool for assessing the ocean content knowledge of high-school students in both countries. The item-difficulty hierarchy was consistent between the two groups, further supporting the construct validity of the instrument. Particularly, respondents in both countries had the greatest difficulty with the questions concerning a) the ocean's connection to all of the earth's water reserves, b) the deep ocean ecosystems that are independent of energy from sunlight and photosynthetic organisms, c) the pollution sources which put the most oil in the ocean, and d) the earth's carbon cycle. Conversely, the easiest items to address for both groups concerned a) the ocean's surface coverage on earth, b) the hydrological cycle, c) the ocean's influence on surface temperatures, and d) how temperature and light availability change with increasing depth. Overall, participants demonstrated low to moderate levels of knowledge. The use of the SOLE could contribute to the assessment of the quality of marine education, as well as to the cross-cultural comparison of ocean literacy. Information on both issues is valuable for the improvement of ocean literacy.

Everyone's Skagerrak

Jensen M. M., Larsvik L.

University of Gothenburg, Sweden

The Lovén Centre at the University of Gothenburg has had regular marine outreach activities since the 1980'ies. Schools and the general public can throughout the year visit Sweden's two largest marine research stations to learn more about the sea and about marine research. The Lovén Centre is also the host of research camps for youths where they work according to the methodology "to think like a scientist".

In November 2014, two marine biologists conducted a tour of non-coastal parts of western Sweden, with the hour-long program "Everyone's Skagerrak", meeting 770 persons. The program began with an introduction of the Skagerrak: the connection between the district we visited and the Skagerrak, the marine life and the ecosystem services we get from the Skagerrak. We showed three films concerning research on changes in the ocean environment: ocean acidification, invasive species, and eutrophication. We also brought our mobile touch pool where participants got to explore 15 spectacular marine species with several senses.

Finally, the participants built a food web on the Skagerrak Wall, a 2 m² felt screen. We then introduced a disturbance – natural or anthropogenic – and participants were asked to describe consequences for the food web and the ecosystem services. The students were given insights into what the impact the disturbance may be up or down the food web. In this interactive part of the program the participant could critically formulate positions to solve problems and take responsibility for our Skagerrak's future. Participants could act as both policy-makers, consumers and citizens. The project was evaluated orally by the students, and written by teachers. From the written results, 89% of teachers indicated that the project fitted well into their current teaching and 68% reported that it had increased their interest in working more with the sea in their teaching.

The Kingdom of Photophilous Algae: a tale created by pupils of the second grade of an elementary school in Crete (Greece)

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²*Hellenic Centre for Marine Research, Institute of Marine Biology, Biotechnology & Aquaculture, Gournes Pediados, Heraklion, Crete, Greece*

³*AQUALEX MULTIMEDIA CONSORTIUM, Dublin, Ireland*

The work presented took place within the framework of the Pan-Hellenic Educational Conference on Algae held in the Cretaquarium, Crete (27-29 March 2015) aiming to help pupils to acquire scientific knowledge concerning algae and their importance in the marine ecosystem (1st prize awarded for scientific and educational approach). The knowledge content (1), skills-building (2) and awareness-building (3) objectives were: (1) to gain knowledge and experience of marine biodiversity; to know how to identify algal species and indicators of pollution; to gain knowledge of appropriate scientific terms; to make contact with marine scientists and understand aspects of their work; (2) to work in groups undertaking assigned roles (co-operation skills); to expand linguistic and expressive abilities (communication skills); to create an authentic story using accurate scientific terms, to handle computers in the classroom; to develop skills associated with theatrical expression; (3) to learn ways of protecting the environment, to bring the school into contact with both the local and the scientific communities. To achieve these ends, the teacher followed inquiry-based learning methodology, experiential learning, group-working, working in the field, creating and producing a knowledge-based dramatic output. The teacher and pupils co-operated with marine scientists of the Hellenic Centre for Marine Research (HCMR), creating a tale based on a current scientific problem: the introduction of marine species in the Mediterranean Sea through the Suez Canal (Lessepsian immigration), by investigating possible impacts on the Mediterranean ecosystem and seeking management interventions. Towards this end, the marine scientists presented relevant scientific materials (e.g. presentations, visit to experimental aquaria with Lessepsian species, informational videos). The pupils undertook supervised fieldwork, collecting biological samples and analysing them in the HCMR laboratories. Furthermore, after having collected scientific material in groups, they worked with activities worksheets and finally created, wrote and digitized their authentic story.

Session 2b The Way Forward: Innovative Methods of Promoting Ocean Literacy

Communicating Ocean Science for Informal Education course launched in Europe

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¹*The Lawrence Hall of Science, University of California Berkeley, CA, USA*

²*University of Gothenburg, Sweden*

The University of Gothenburg is to the first university in Europe to offer the Communicating Ocean Sciences to Informal Audiences (COSIA) course to its marine science students.

COSIA¹ is a university course that was created at the Lawrence Hall of Science (the Hall²), the public science center of the University of California at Berkeley. The Hall evaluated, improved and documented the course, and now it is being taught at 25 universities throughout the United States. The course engages the future scientists in learning to communicate their (ocean) scientific knowledge with the general public in informal environments (e.g. science centers, public aquariums) by immersing students in discussions, activities and practical experiences related to research on how people learn. The course – taught by university ocean scientists in collaboration with science educators in science centers and aquariums – introduces students to inquiry-based science pedagogy and communication strategies and quickly places them in a teaching practicum experience in an informal science education institution. The students learn about teaching ocean sciences in informal environments and apply their understanding in a six-week practicum (approximately two-three hours per week) where they facilitate hands-on activities in the informal setting. The goal of COSIA is to create a generation of ocean scientists who begin their careers understanding the critical importance of engaging in education and public outreach. Even though education and outreach might end up being a relatively small portion of their job, we now have some evidence that these future scientists approach it with the same level of commitment and sophistication that they approach their research”. The University of Gothenburg will be a pioneer by implementing this course in European higher education with the help of the Lawrence Hall of Science.

Educational projects type "summer school" and volunteering methods as promoting environmental education

Curlisca A.

The Museum of Natural Science Complex, Constanța Romania

In current conditions when the environmental issues are an undeniable reality, environmental education is essential in approaching and resolving them. Constanta Dolphinarium, part of the

1

http://www.lawrencehallofscience.org/services_and_expertise/professional_development/k12_science_professional_development/cos

² <http://www.lawrencehallofscience.org>

Natural Science Museum Complex Constanta is a focal point on the Romanian Coast for education and dissemination of conservation and environmental protection. Although the topics addressed by our specialists are varied, the focus is on the marine environment. Topics approach were achieved in classic way through: lectures, information, public education, management, informing and training the public to take part in conservation and protection of natural resources in protected areas. This type of approach has a low receptivity of the subject and is presenting a lack of interest for the public. That is why our institution specialists have sought new ways of acquiring knowledge related to the environment and awareness of the issues raised by their protection. A new approach to environmental issues was the summer school; the educational project "Black Sea" conducted for 6-7 days in September 2007 and 2008 and it aim was the formation of interest regarding the knowledge and protection of SEA at the youth level. In 2014 were recorded numerous voluntary requests, most of them being from pupils and students. This gave us the opportunity to approach the environmental education in a new way. Volunteers are apprentices from our institution specialists and under their guidance develop their skills of observation, experimentation, research, and, of course an ecological ethics. Considering the fact that volunteers are also part of the public, they can facilitate the dissemination of the results of the environmental education participating directly as educators or guides for visitors. Meanwhile they can use the knowledge acquired at the museum to school. All this makes them true promoters of environmental education.

Monitoring, management and conservation of local cetacean populations using marine stewardship strategy: the case study of “Maresme Canyons” (NE Spain) 6 years later

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SUBMON - Conservation, study and awareness of the marine environment.

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Marine stewardship is a strategy intending to generate accountability among civil society for the conservation of marine natural environments through marine stewardship agreements. The implementation of this strategy is a new tool for cetacean conservationists in the Mediterranean and it has been accepted among other conservation strategies and directives as a complement for the protection of endangered habitats and species. Marine stewardship promotes the participation of stakeholders in the sustainable management of specific areas in a way that conserves all its ecological values. “Canyons del Maresme” is a wide area (3,400km²) located off the Catalan coast (NE-Spain), where this marine stewardship strategy is being implemented. The area reaches the edge of the continental shelf at 20 nm of the coastline, where the seafloor suddenly drops to over two kilometres, configuring a habitat for a wide diversity of species. 5 different cetacean species have been cited in the area, but focused monitoring programs are conducted in local populations of bottlenose and Risso’s dolphin. These studies have involved the nautical sector, fishermen and fishing industry, and local administrations. The initiative began in 2009 in collaboration with the Autonomous Government of Catalonia. During this period, steps accorded and data obtained have been of notorious relevance, a fact that has led to create a lobby to start promoting the protection of this marine area. After six years of implementation a widespread network of trained volunteers among the different stakeholders has been established. Participants have reported data on cetacean sightings, have provide images to the photo-identification catalogue of

bottlenose and Risso's dolphins, and are implementing best practices both for sailing and fishing. Besides ocean literacy activities have been conducted to promote responsibility on the marine heritage of the area among citizens of the 14 cities and villages along this marine stewardship area.

Establishing a multi-stakeholder PERSEUS@School consortium in Malta

Deidun, A.¹, Galea, A.², De Castro, D.², Papathanassiou, M.³, Streftaris, N.³, Papathanassiou, E.³

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²*Malta National Aquarium*

³*Hellenic Centre for Marine Research, Greece*

The [PERSEUS@SchoolNetwork](http://www.perseus-et.eu/en/schools_network/index.html) (http://www.perseus-et.eu/en/schools_network/index.html) is an initiative for schools, teachers and students who participate in Environmental Education Programmes which address the marine environment. The network will offer the opportunity to school students to study environmental issues and problems of their region and share opinions about the different ways through which young people can help to protect the historic waters of the Mediterranean and Black Seas.

Against this background, the Physical Oceanography (PO) Unit at the University of Malta established for the first time a broad partnership with different ocean literacy stakeholders in order to implement the objectives of PERSEUS@School in the Maltese Islands. The partnership features an academic entity (the University of Malta), a government entity (Malta Tourism Authority), an aquarium (the Malta National Aquarium) and an environmental NGO (Sharklab).

The first activity organised by the Maltese PERSEUS@School partnership enjoyed the patronage of The President of Malta's Office in commemoration of the 2015 European Maritime Day. Students aged 10-13 were chosen on the merits of a national competition launched by the Malta National Aquarium. The authors of the winning submissions were invited to participate in a comprehensive ocean literacy activity, which featured briefings about the major challenges facing the integrity of our seas and the conservation of vulnerable marine species, such as sharks, tours of the aquarium facilities, screenings of underwater documentaries and Q&A sessions between the students and the invited experts.

Students participating within this first ever PERSEUS@School event in Malta will be eligible to be selected as PERSEUS 'Ambassadors', who will be entrusted with delivering a short presentation to the European Parliament this December. Such an event marks the culmination of youth empowerment and follows on the mould developed within the Eco-School network, within which students are allowed to hold a special session within national Parliaments across Europe.

The oxygen from the Sea that I breathe: a concert and a ballet about the life of the phytoplankton.

Gaspar R.¹ & Mestre M.
¹*Ocean Alive, Portugal*

Most people think the oxygen we breathe is originated in terrestrial forests and doesn't know the important regulatory role of the Ocean producing the majority of oxygen we breathe. In order to foster the idea that the ocean is green, a creative marine education workshop was produced in a public garden combining marine science, dance, voice and painting.

The originality of this activity was 1) the use of a garden as an experimental aquarium to teach marine biology and 2) incorporating creative arts to consolidate scientific understanding.

By using a garden, we showed that a workshop about the sea can be carried out at any garden, even if far away from the sea. For instance, the vegetation and green patches can be compared with patches of seaweeds and of phytoplankton. The phytoplankton living in the lake was collected with an appropriate net, was observed under a microscope and compared to marine species. The production of oxygen by the aquatic phytoplankton from the lake was measured using an oximeter and tested in sealed vials exposed to various conditions.

Understanding the biological and oceanographic processes related to oxygen production by the marine phytoplankton was facilitated by the inclusion of artistic expressions (painting, voice and dance) alongside with images, diagrams and videos about the theme. Together, these elements supported the creation of a final concert and ballet about the life of the marine phytoplankton and its importance in our daily life.

The workshop lasted one week, targeted children from 8 to 12 years old and was conducted by a marine educator and a dancer. It was conducted in July 2013 and 2014 for the "Discovery" - Cultural and Scientific Department of Calouste Gulbenkian Foundation, Portugal.

Overall the workshop had a very positive evaluation and fostered a remarkable scientific questioning among participants.

WORKSHOPS

1. Storytelling - Scuttlebutt, Sea Shanties, and Social Media – the use of storytelling to encourage engagement in ocean science.

Facilitators- Natalie Welden and Rachel Summers (Field Studies Council UK)

Purpose: It is likely that all of us will have been touched at one time or another by a tale of the ocean, whether your tastes run to the likes of Ernest Hemmingway’s unlucky fisherman in *The Old Man and The Sea*, Calum Roberts’ historical depictions of the development and downfall of the fishing industry, or James Cameron’s *Titanic*. For centuries the sea has been the backdrop to, and source of, countless inspiring and fascinating tales. In this session we will demonstrate the importance of storytelling in conservation, discuss and develop the use of narrative as a tool to condense information and inspire an emotional connection. Working with the group we will assist attendees in identifying the story in their own work and discuss the best way to communicate it with the world.

Process: The session will begin with a brief introduction to the use of storytelling to present scientific ideas, followed by a number of modern case studies of successful conservation storytelling, identifying the elements that have made them so influential. We will then introduce the use of frameworks to build an effective and flowing narrative which returns repeatedly to the topic to reinforce the ideas of marine literacy and conservation. Attendees will be invited to introduce their own specialism or area of interest, working with others to identify key areas of focus, before developing their own marine science story. We will then finish with by covering some of the most effective ways to impart their marine science stories – whether as a structured lesson, bite-sized chunks such as tweets, or an ongoing blog.

Uses: To improve attendees ability to confidently and concisely communicate their work and effectively engage people with marine science stories in a short time-frame.

Expected Results: During the workshop, participants will develop and improve essential communication techniques, as well as gaining insight into the work of other attendees. By encouraging participation from a wide range of organisations, participants will be able to promote their own work to representatives of other institutions and benefit from a wider range of experience and perspectives.

2. Communication – Speed course in Marine Science Communication

Facilitators– Jan Seys (Flanders Marine Institute (VLIZ)) and Geraldine Fauville (University of Gothenburg (UGOT) (Anouck Hubert (Réseau des Universités Marines Françaises -France) & Kim Marshall-Brown (NOC-UK))) on behalf of the European Marine Board Communication Panel

Purpose: This new one hour marine science communication workshop is based on the observation that young marine scientists are often being asked to deal with communicative tasks they have not been trained for (e.g. dissemination activities in European projects). By organizing a “speed course”, EMBCP wants to specifically target those researchers and lay the foundations for science communication expertise. Participants will be provided with hands-on experience, tools and tricks and be prepared for some general communication and outreach activities and challenges. This workshop follows from what was felt as a need at the 1st International Marine Science Communication Conference (IMSCC-1, Porto, 8-9 September 2014) and is a warming-up exercise towards IMSCC-2 (Bruges-Ostend, late 2016).

Process: The workshop will be jointly presented by a team of professional marine science communicators, and will focus on four selected challenges. Each of them will be introduced and framed, demonstrated in an interactive way by showing some best practices and concluded with “read-more” links. The four topics are: (1) Setting the **scene** and how to organize **events** for a wider public while making use of **social innovation** principles (Jan Seys, Anouck Hubert); (2) How to deal with the **media**: from how media work to how to write a good news release and create impact (Kim Marshall-Brown); (3) What about the use of **social media** (Géraldine Fauville); (4) How to set up a Citizen Science project (and keep it going)(Ferdinando Boero).

Expected Results: Although many tools apply to science communications in general, by using examples from the marine scientific community, this workshop will create the appropriate ocean atmosphere and help to bridge the gap between theory and practice. It will also demonstrate innovative approaches and ways to network at an international level.

3. Marine Litters App - Surveying marine litter on the coast: a way to promote environmental education and awareness

Facilitators: Christos Ioakeimidis, Martha Papathanassiou, Vasiliki Kopanou (Hellenic Centre for Marine Research, Institute of Oceanography)

Purpose: The purpose of the workshop is to promote an innovative and attractive way of enhancing environmental awareness and education to children through the introduction of smart technologies.

Process: The smartphone application *Marine LitterWatch* (MLW) developed by the European Environment Agency (EEA) has been developed to target communities interested in marine litter activities. Along with that, MLW has been used by the PERSEUS (FP7) Research Project’s educational network “My school voyages with PERSEUS” and has been proven to be an ideal tool for school purposes. *Marine LitterWatch* is available for both

Android and iOS devices based on a standardized monitoring protocol through which children can create beach clean-up events, even monitor (MSFD) marine litter on beaches. The app uses the Marine Strategy Framework Directive list of marine litter items that has been harmonized across Europe and is ideal for the creation of surveys on litter items found on the beach i.e. plastic items, cigarette butts, bottles, fishing materials, etc. The collected data are stored in a public database hosted by the EEA. The users can retrieve their data through a web interface and use it in other databases and / or elaborate it further into a wide range of products such as survey reports and maps.

Uses: Environmental education teaching tool, which could be used world-wide along the beaches.

Expected Results: The major expected results are:

- i. Schoolchildren should realize that marine litter is a major environmental problem in which human behavior plays a major role.
- ii. MLW should decisively contribute in strengthening schoolchildren awareness on marine litter as well as altering their whole perception on littering and waste.
- iii. Realize marine litter's negative impact on marine environment; clearly defined the causes and understand the important contribution and longevity of certain marine litter items i.e. plastics on marine littering.

4. [OL core curriculum](#) - Embedding Ocean Literacy in the Core Curriculum for 5-14 Year Olds: Innovative instructional materials and model programs.

Facilitators: Craig Strang (Lawrence Hall of Science, UC Berkeley, USA) and Ania Driscoll-Lind (American School in London, UK)

Purpose: This workshop will inform and assist the development of a plan for promoting European Ocean Literacy by providing examples of effective, research-based pedagogy, instructional materials and models of scalable programs in ocean science education. Extensive research and successful professional development programs with educators has established that students learn complex science ideas about the ocean best by engaging in hands-on, student-centered learning experiences in which they have first hand experiences with phenomena and opportunities to construct and discuss their explanations with their peers. Teachers can engage in pedagogical approaches that are supported by research and promote this student-centered learning. Schools need the engagement of external partners, such as aquariums, museums and universities, in order to make substantive improvements in the quality of the science experiences they provide to their students.

Process: Participants will directly engage with examples of proven and research-based classroom learning experiences that promote Ocean literacy. These learning experiences will be drawn from field tested, published instructional materials developed and widely used in the U.S. in Kindergarten through Grade 8 (ages 5 - 14).

During the second half of the workshop participants will reflect on how the learning experiences reflect current research on learning, and the presenters will provide an overview of ocean sciences curriculum materials and programmatic approaches that build students

understanding of complex ideas over time from their early primary years up through early secondary. This ocean sciences curriculum, developed by the Lawrence Hall of Science at the University of California, Berkeley, is the result of several years of research, “pilot teaching” in multiple classrooms by the developers, and extensive field testing by dozens of classroom teachers across the United States. Participants will have the opportunity to experience specific lessons, review student books and teacher’s guides, learn about scalable program implementation models, and to engage in a discussion of the possible application of these instructional practices, concepts and models to their own specific institutions, classrooms and outreach programs.

Uses: The educational materials, books and activities presented in this workshop will be useful for a wide range of conference participants from school teachers in their classrooms to university program and outreach staff. Teachers will leave with specific lessons that they can use immediately in their classrooms, and university, aquarium and NGO staff will leave with a deeper understanding of resources and program models they can use to support the improvement of science teaching and learning in school systems. This workshop will begin a dialog about potential partnerships between educators in the European Union and the United States that support the advancement of ocean literacy and the improvement of educational systems for supporting science teaching and learning in schools.

Expected Results: The workshop will provide educators with models and actual resources for promoting ocean literacy. Professionals in all aspects of ocean science education including classroom teachers, teacher leaders, aquarium, museum and other informal science education professionals, and university faculty and staff involved in ocean literacy, science and/or ocean science education research and outreach.

POSTER ABSTRACTS

Teaching Seagrass Ecology and Conservation in Secondary School using Interactive Tools

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A teaching suggestion, utilizing Interactive teaching tools, aims to acquire knowledge on seagrass ecology to students of Secondary School, and make them aware of seagrass conservation. Seagrasses occur widely in coastal zones throughout the world and form ecosystems, which play important roles in fisheries, fish nursery grounds, prawn fisheries, habitat diversity and sediment stabilization [1]. The suggestion is composed of a module of three units; each unit can be implemented in at least three teaching hours. Students can work in teams of three-four persons. Concerning the first unit, students, using interactive whiteboard, discuss and note down in worksheets their pre-existing knowledge on issues regarding seagrass ecology, the value of seagrass to humans and the occurrence of seagrass declines. Thereafter, through interactive activities [2,3], they are dealing with issues and information on the seagrass flora, seagrass morphology, the origin and evolution of seagrasses, seagrass biogeography and distribution of seagrass floras. In the second unit, using interactive teaching tools, they get in touch with information concerning seagrass ecology issues, such as habitat requirements of seagrasses, seagrass abundance and productivity, population and community dynamics, fauna associated with seagrass systems. In the third unit, students collect information from the internet, discuss and answer questions in worksheets that focus on the value of seagrasses to humans, the large-scale declines of seagrass meadows, the natural and anthropogenic causes of declines, as well as on monitoring, management and restoration of seagrass meadows. Finally, students discuss all together and record their suggestions, regarding the actions that are necessary for the conservation of seagrass meadows. Taking into account that the proper utilization of new technologies, when teaching Sciences has many positive effects [4], it is expected that the application of our teaching suggestion will contribute to the preparation and the gradual shaping of ocean-literate persons and therefore to a more efficient development of the Ocean Literacy.

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The correlation between biology and design in understanding the nature and environment

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In 2012, Natural History Museum Rijeka started the new program in collaboration with the Scholl of fine arts in Rijeka according to the facts that the nature of its originality, beauty, richness of forms and colors always has been the interest of scientists and artists. The program was consisted of educational workshops on the sea wildlife, with the aim of knowledge that the sea is a valuable natural resource. The project is designed through short, popular and applied lectures and workshops to introduce marine organisms, from the simplest to the most complex ones, from their structure, forms, suitability to the environment and the importance of interacting with other living organisms including the human beings and the environment. The main goal was encourage students to reflect on the importance of preserving nature and creative expression using structural elements of living beings in the creative work and the design of smaller projects in industrial design and other art techniques, exploring the biology and ecology of marine organisms using the basic laboratory techniques . Each project task is accompanied by an exhibition of student work and the results of cooperation was available to public at the exhibition opened in the Natural History Museum on International Museum Day, 18 May. The exhibition of students artworks was accompanied by a small Natural history exhibition according the topic of the programme, and the goal was the correlation between the natural history knowledge and art design and cooperative learning deepens knowledge and raises awareness in the understanding of nature and the environment.

Go Global and Cross the Atlantic with the AORAC-SA project

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Good ideas travel fast!

In the Atlantic Ocean Research Alliance Coordination and Support Action (AORAC-SA) project we will work to make good ideas and best practices travel even faster by promoting exchanges between educators in both sides of the Atlantic.

There is just one Ocean and the collaboration of the Marine Educators across the Atlantic is essential for the future of the Ocean Literacy.

The AORAC-SA project will provide scientific, technical and logistical support to the European Commission in different areas.

In particular in the area of Ocean Literacy we will spot, with the collaboration of Marine Educators, the most promising projects to enhance trans-Atlantic cooperation in the areas of education and ocean awareness and stewardship.

Rigs-to-Reefs & Ocean Awareness Destinations: PrinosOffshore Platform Complex Re-use.

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Once an offshore oil platform stops producing at a profitable rate, it is usually abandoned and the structure must be decommissioned. The Rigs-to-Reefs (RTR) practice provides an alternative to the complete rig removal by converting it into an artificial reef, thus protecting the coral reef that has grown on and around the submerged platform during the rig's productive years, as well as the significant marine life supported by it. In this work, an alternative rig-to-reef plan is proposed for the case of the Prinos offshore platform complex in the Gulf of Kavala, Greece, which was installed in 1979. As production rates have been lately declining, it is expected that the rigs will be abandoned in the near future. The proposed plan envisions the reuse of the Prinos complex (platforms A, B & D) as a reef and ocean awareness destination. The objective is the promotion of reef and marine literacy, as well as the promotion of similar rig re-use all over the world. The rig complex will be used to foster reef and ocean awareness by hosting different parallel uses that combine research, education and recreation. The proposed uses include educational labs, research labs, underwater reverse-aquarium, diving center, exhibition area, multi-purpose space and a restaurant-cafe. Due to the variety of the parallel uses the target groups will be schools, science and diving tourists, as well residents of the local inland area. The rig complex will be renovated by removing parts that are no longer useful. The rig structure's free plan offers sufficient flexibility and the capability to plug in or remove pieces according to the evolving needs. The spatial organization of the proposed activities/uses on the platforms is discussed and presented in the paper, as well as the features of a supportive infrastructure that hosts complementary activities in the vicinity of the platform.

Planeetzee@work, marine lab work experience.

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Nothing is more educational for young science students than spending a day amongst marine scientists. The ocean, seas and coasts are valuable and exciting fields for science education. By using ocean science concepts, a teacher can pimp the regular science classes and motivate students in learning science (Bonderup Dohn 2010). Moreover, the multidisciplinary character and the distinctive practices in ocean sciences have been documented to arouse unique effects on the overall science performance of a student (Lambert 2006). As the current science education in school laboratories is facing many challenges, out-of-school experiences in a research lab might address the need for inspiring materials, working with modern -and often expensive- science technologies and relating science to a students' life. Teachers can also benefit from the scientist-teacher partnerships as they are a unique contribution to the professional development of science teachers. More reason to take teachers and students out of school and bring them into a marine lab!

In the project 'Planeetzee@work', Belgian marine research labs welcome science students between 16 and 19 years for an intense hands-on and enquiry-based workshop in their facilities or in the field, being a beach, harbor and estuary or even at sea. In this workshop, students experience first-hand how marine scientists design their research, obtain evidence and use data. While the students conduct experiments, they also learn about the daily routines of a marine scientist, training and career opportunities and the societal importance of their work. After the workshop, the students can compete with the other classes in the project in a scientific poster contest. The best poster is rewarded with a multiday marine expedition abroad.

Planeetzee@work is an initiative from the Flanders Marine Institute (VLIZ) in collaboration with Belgian marine research groups and institutes, with support of the Flemish Government.

URL project: www.planeetzee.be/wedstrijd (in dutch)

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How far can a little boat foster ocean literacy?

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An unmanned sailboat named WEST equipped with a GPS and a satellite transmitter was launched in 2013 by students of an American school in the scope of the “Educational Passages” program. They tracked WEST across the Atlantic Ocean until it arrived to the Portuguese coast. Scientists from MARETEC runned simulations and a rescue operation by the local authorities ended with success recovering. With the WEST arrival an exciting educational adventure began. Teachers and students from two schools near the grounding point were challenged to participate on an educational project entitled “WEST Takes Portugal to the World”.

Four stages were designed. In the first one, the broken boat was displayed at the schools and a researcher expert in oceanography explained how it was able to cross the Atlantic, drifting with winds and currents.

The second stage comprised a multi-disciplinary (arts, geography, languages and history) learning experience. Students were given a layout of the boat to be painted and they were asked to write a message in Portuguese and English to be sent. This drived them to do a lot of research about the American culture, as well as about their own culture, currents.

In the third stage, after visiting the shipyard to see the restoration of the boat, students decorated the hull themselves.

The fourth stage consisted on the public presentation of the project where students were able to interact via Skype with their American colleagues

WEST will return to the Atlantic. The WEST travel will be monitored by students from both sides of the ocean. This will lead to a new educational project for schools.

With this simple educational project we could explore one of the ocean literacy principles: The Ocean and humans are inextricable interconnected, and it is also an important element in the heritage of many cultures.

Innovative use of film, animation and active science to engage primary school students in developing ocean literacy

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Andy Crabb, resident filmmaker at SAMS, spent one month working with pupils at Lochnell Primary School, marine scientists from the Scottish Association for Marine Science (SAMS), a professional animator, a local fisherman, and traditional musicians to produce a short film combining live action and stop motion animation about the local marine food web.

During the first two weeks the children learnt about the marine food chain and about fishing. Scientists from SAMS visited the school to assist the 25 children in active learning about the

marine food web, using a beach trawl to gather samples from the local beach, teaching microscope skills, and playing interactive games about marine food chains. We made a short video showcasing the work of a local scallop diver, who then showed the children his boat, diving equipment and scallops!

We then helped the pupils develop storyboards of their ideas for a short film. All the ideas were eventually gathered together to produce a single script. Working with the class, art teacher Alison McCrindle, and professional animator Jessica Ashman we make a short film combining live action and stop motion animation about marine food webs based on the children's very imaginative story. The pupils made props and sea creatures and learnt to create a large-scale stop motion animation over one week.

Finally traditional musicians Chris Stout and Catriona McKay composed and recorded an original music-score for the film. In May 2015 the film was screened at a concert in Oban with the composers/musicians playing live accompaniment to the film.

The completed film can be viewed at : <https://vimeo.com/114856537>. The entire learning process has been fully documented with photos, video and time lapse photography.

Initiative by the Erasmus+ ‘SeaofSkills’ Consortium to reinforce Continuing Vocational Education and Training (CVET) for Fishers

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Opening access to and raising adult participation in quality lifelong learning programmes lies at the heart of current EU education and training, as well as economic growth and social cohesion policies. Continuing Vocational Education and Training (CVET) is relevant to key objectives set in the context of the Europe 2020 strategy and the EU Social Investment Package for Growth and Cohesion, while is crucial to reaching the target of 15% average participation by adults (age 25-64) in lifelong learning by 2020.

The fisheries sector is recognized as one of the pillars of development and is set as a cornerstone of the EU Blue Growth Strategy and the Integrated Maritime Policy. The extent of its contribution to sustainable development, economic growth and food security, however, highly depends on the knowledge, skills and competences of fishers.

Within this framework and based on identified needs, the *SeaofSkills* project, funded through the Erasmus+ Programme, is working on developing a CVET material for small-scale fishers. Training needs will be characterised through field surveys being conducted in Chios (Greece), Çeşme (Turkey) and Malta. Accordingly, the material produced will be pilot-tested and evaluated by fishers in the 3 target areas. Special attention is being paid to the integration

of existing regulations and recommendations regarding the fisheries and CVET sectors at the international level (IMO, OECD), at the European level (DG Education and Culture, DG Maritime Affairs and Fisheries) and at the national level (national accreditation systems, etc.).

Project training outputs will be communicated to fishers during project multiplier events. A learning outcomes approach will be adopted within the project, so as to operate within the provisions of the European Qualifications Framework (EQF) and permit the future recognition and accreditation of the generated material. A policy recommendation on CVET for small-scale fishers will also be developed within the project.



"The European Commission support for the development of this project does not constitute an endorsement of the contents which reflects the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein."

From the Research Project to the Class Room: II. Embedding Short-Term Projects into a Stable Framework.

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Projects like the Collaborative Research Centre 754 (cf. Poster I) or the Priority Programme "Climate Engineering" by the German Research Foundation dedicate part of their resources to outreach activities for schools. Within these projects, methods and materials for education are developed that are meant to outlast the end of the respective funding periods.

At GEOMAR in Kiel this continuity is provided by embedding these activities into the existing framework of the centre's school programmes: Proposals for outreach projects that transfer scientific content from research to schools are initiated by GEOMAR and – if successful – the resulting projects are carried out at the research centre. GEOMAR provides additional staff, rooms, logistic support and a permanent internet platform on which materials remain available beyond the end of an education project. A coordinator employed by GEOMAR constitutes the link between different concurrent as well as consecutive projects. Schools looking for opportunities to interact with research are brought into contact with partners from the respective outreach projects. Further support is given by the State of Schleswig-Holsteins Ministry of Education, which delegates teachers on a part-time basis to contribute to pedagogical aspects of this work. On the national and international level, GEOMAR links into education networks (e.g. the School Labs Network of the German Helmholtz Association), thus opening channels for a wider acknowledgement of the results of individual outreach projects and to cooperations with different partners.

**The Kefallinia island Municipal Aquarium-Museum:
a hub developing the underwater natural and cultural resources of the Ionian Sea and
advancing the ocean literacy to the public.**

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The Lixouri Aquarium-Museum in Kefallinia Island, Greece and its twinning with that of Santa Maria al Bagno in the Salento peninsula, Italy, are recently established Hubs in the Ionian Sea funded by the European Territorial Cooperation Programme, Greece-Italy 2007-2013.

The objectives of the Kefallinia Aquarium-Museum are: (i) exhibiting to the public the underwater natural and cultural treasures of the seas surrounding the island, (ii) the functioning of a recreational/vocational hub for all educational levels but also for sea users and stakeholders, to raise their awareness of the seas and engage them in the European notion of the **Blue Growth** of the Seas and (iii) setting up diving parks.

The Aquarium-Museum exhibits include: (i) five tanks displaying the two most important benthic habitats in the Mediterranean Sea, that is, the *Posidonia oceanica* and the *Coralligene* assemblages with the associated rich fauna, (ii) three dioramas displaying scale model replicas of the three best preserved ancient and historic wrecks and (iii) three documentaries, the first two of which present the complete story of two well known 2nd WW wrecks. The third documentary deals with the birth place of seafaring in the Greek Archipelago by Neanderthals and modern humans between 115 and 35 thousand years ago.

The Aquarium-Museum starts from next year (a) educational programmes for school children to discover the mysteries of the seas and marine life and (b) recreational/vocational holiday activities centered on eco-diving and giving the public the opportunity to: (i) observe the Mediterranean flora and fauna and (ii) get involved in mapping and monitoring NATURA 2000 sites around the island and thus actively engaged in the **Blue Growth** of the seas

The exhibition themes in the Aquarium-Museum as well as the recreational /vocational and educational activities are prepared by the OCEANUS NET laboratories of Patras University and were selected after surveying the seafloor using the latest state of art sonar and camera technologies.

How does participation in Educational Outreach Benefit Scientists?

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For almost a decade, scientists and educators have been collaborating on several education and public outreach initiatives as part of the Centers for Ocean Sciences Education

Excellence (COSEE). While the goals and strategies of the COSEE are multi-faceted, during this session we will share results from research conducted to learn about the impact of these collaborations on scientists. Study data collection includes interviews of 14 scientists designed to support the development of a scientist survey that served as the main data collection method for this study. The final scientist survey was sent to 1,841 COSEE-involved scientists. With a response rate of 41%, we analyzed 767 completed surveys. Analysis of survey and interview data revealed several direct benefits to scientists: (1) support for accessing research funding through help in developing broader impact and EPO (education and public outreach) statements; (2) opportunities for the scientists and their graduate students to engage in education and outreach; (3) personal fulfillment and enjoyment of engaging in education and outreach; (4) change in attitudes about teaching, learning, and the role that public understanding of science plays can play in society; (5) change in their own teaching practice; (6) change in thinking about their scientific pursuits; (7) increased demand and support for science research funding through public understanding; and (8) developing more institutional support for scientist participation in education and public outreach. This study shows there is an intensity and duration of engagement needed in order to witness the types of transformative outcomes we observed among a subset of survey respondents. It suggests that substantial investment is required to meet to transform relationships between scientists and educators.

Perseus@school- An international school network, on sea key thematic areas, inspired by the research project PERSEUS

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⁵ *2nd Lyceum of Kaisariani*

⁶ *1st High School of Dafni*

⁷ *52nd High School of Athens*

⁸ *4th High school of Patras*

⁹ *56rd High school of Athens*

¹⁰ *16th High School of Patras*

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“My school voyages with PERSEUS” - PERSEUS@SCHOOL is an international environmental education thematic school network, inspired and supported by the European research project PERSEUS (Policy Oriented Marine Environmental Research in Southern European Seas <http://www.perseus-net.eu>). The project is funded through FP7 under the “Ocean of Tomorrow” and it is coordinated by the Hellenic Centre for Marine Research (HCMR).

PERSEUS@SCHOOL network involves about thirty Primary and Secondary schools from different regions of Greece (900 students and 60 educators) as well as schools from Romania, Malta, Turkey and Spain. It is coordinated by the Institute of Educational Policy of Greece (IEP) in collaboration with the HCMR and aims to help and enhance environmental

education, focusing on clean seas stewardship in schools. Educators together with marine scientists have a role in supporting and inspiring children to acquire the knowledge, skills and inspire their awareness to live and work as responsible and concerned citizens.

For this purpose, the network has designed specific pedagogical activities for primary and secondary education – based on PERSEUS key thematic areas; Marine biodiversity, Overfishing, Chemical Marine Pollution-Bioaccumulation-Health, Eutrophication in Marine Waters and Marine Litter, have been considered. In addition, two web-monitoring campaigns are used by the network; the Jellyfish Spotting and the Marine Litter Watch (MLW) application (developed by EEA and supported by PERSEUS). Special emphasis is given to MLW app, as school students used this innovative tool in order to monitor beach marine litter in selected areas in the Mediterranean and the Black Sea.

The present work refers to the Greek part of the network, which is leading this initiative, from September to May in 2014 and 2015. The schools in Greece worked on their local marine projects supported by PERSEUS mentors (scientific and pedagogical). Educators along with mentors guided students to achieve their project aims.

“Bridges between School and Blue Science”: a case study to measure Ocean (Science) Literacy

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"Bridges between School and Blue Science" is an educational project whose main objective is the active integration of high school students in real ocean research settings. By creating partnerships between high schools and ocean science centres, young people aged between 14 and 18 can actively participate in scientific research in ocean-related area side by side with scientists in their professional contexts.

Using the concepts described by Pouliot (2008), “Bridges between School and Blue Science” allows students to familiarize themselves with ocean science in action, to develop their capacity for evaluating the information made available to them on a daily basis, to make decisions concerning controversial sociotechnical issues, and to take part in debates and discussions on sociotechnical controversies of concern to them.

Assuming that science content and social components will contribute to ocean literacy (Greely 2008) we expect that this educational program promotes ocean-literate persons that understand ocean science, can communicate about the ocean and are able to make informed decisions about ocean policy (COSEE, 2005).

To evaluate these main features we accomplished a preliminary qualitative assessment using the socioscientific issues (SSI) based instructions, adapting the method described by Greely (2008).

We performed open ended queries and interviews to our students and the preliminary results showed that there was an improvement in the student’s ability to identify scientific issues, explain ocean phenomena scientifically and use of ocean scientific evidence as arguments in their discourse.

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Innovative ways of communicating marine science by using textile design as a medium to increase ocean literacy

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Crùbag creates luxury scarves and stunning interior textiles inspired by the beauty and hidden secrets of our oceans and marine research. Crùbag believes marine science is beautiful. Using the evocative power of fashion and design, Crùbag produces a variety of textiles integrated with comprehensive science outreach packages. Each piece tells a story about the oceans, cutting edge research and environmental issues. Collaborating scientists are profiled and their research showcased alongside the designs through the website and printed materials.

We propose the idea that by using textiles as a medium and the power fashion has in society, Crùbag can help science communicators and institutions increase ocean literacy by reaching new audiences effectively and by engaging the consumer on a cognitive, sensorial and an emotional level. Crùbag makes marine research and ocean literacy fashionable and trendy. Crùbag is a connecting platform at the cross-section of science, art, fashion and science communication. Our established niche within the fashion industry, allows us to innovatively engender interest where science alone may not. We aim to excite the general public, the scientific community and policy makers with Crùbag's innovative and multidisciplinary approach to science communication.

Crùbag has attracted the interest of numerous audiences from the public to science/environmental organisations and government officials. Crùbag has successfully produced thought provoking collections. The Gachon Collection was inspired by the research of Dr Claire Gachon (SAMS) on algae/pathogen interactions. For the 130th anniversary celebration of the Scottish Association for Marine Science and the legacy of SAMS founding father, Sir John Murray, Crùbag was asked to create the Murray Collection. Our products increase and disseminate factual ocean literacy and trigger people's imagination and emotional connections, similar to those evoked by charismatic species. By using textile design, marine science becomes a tangible part of people's daily lives.

The Role of Professional Bodies & Learned Societies in Promoting Ocean Literacy

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In 1966 the Society for Underwater Technology (www.sut.org) was established by early adopters of diving and subsea engineering technology to promote their new discoveries to industry, academia, government, policy makers, the general public and schools. Our sister organisation the Institute of Marine Engineering, Science and Technology IMarEST (www.imarest.org) is even older, over 150 years. Both have branches across the globe and have memberships primarily drawn from industry.

SUT has an education and training committee, with a membership drawn from industry, teaching, academia, government research institutes, and NGOs. Many of our member organisations face difficulty attracting high-quality people into industry and in some sectors there is an emerging shortage of skilled staff. For example in the North Sea oil sector the average age of workers is over 50.

SUT uses a combination of public lectures, printed materials, school visits, YouTube, and social media to reach our audience. We're beginning to shift our focus to a younger age group to capture “hearts and minds” earlier in life, and are publishing our first book aimed at younger children in late 2015. We've also begun to focus on non-graduates more than we have in the past.

At the same time as outreach to the next generation, Learned Societies and Professional Bodies are beginning to understand the benefits of helping existing marine professionals gain a wider understanding of the environment within which they work. As industry moves into the deep ocean in the search for hydrocarbons and minerals an improved knowledge of how their activities might impact on the ocean ecosystem and environment helps organisations make better decisions about selection of appropriate technologies, techniques to minimise adverse impacts, reduces insurance costs and where possible provide structures designed to work in harmony with nature, not against.

Educational Cruises Using Research Vessels: A Way to Deliver Environmental Awareness and Education

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The assessment of marine litter was combined with environmental education within the PERSEUS (FP7) Research Project’s educational network “My school voyages with PERSEUS”. Two novel educational research cruises, “Andromeda I” and “Andromeda II”, respectively, were designed for the successive years 2014 and 2015 on board the HCMR’s Research Vessels, R/V AEGAEON and R/V PHILIA, respectively. Schoolchildren from 10 different schools in Greece participated actively in the sampling and assessment of marine

litter in Saronikos Gulf (2014) and Crete (2015). In 2014, a visual operation of benthic marine litter in the Saronikos Gulf (Greece) using the Remotely Operated Vehicle (ROV) MAX ROVER was made. In 2015, trawling experimental hauls were performed in the Cretan Sea, just off the city of Heraklion. In both cases, the abundance and qualitative composition of benthic marine litter were investigated in two selected locations with the ultimate goal being the children's environmental awareness. Although the schoolchildren acted as scientific crew in both operations, experienced scientists accompanied them during the cruises and acted as their mentors. As background knowledge, the schoolchildren studied the basic aspects of the marine environment, among which was the assessment of marine litter on the seafloor, based on a standardised scientific assessment protocol (TGML/JRC). During their survey they identified and classified marine litter properly, according to their description and material given to them before the cruises, in order to be part of the general survey that HCMR performs for litter in the two areas; they felt responsible for their actions and had an additional drive to succeed in their mission. Their concern and interest was recorded through their oral and written evaluation and was confirmed after completing the mission by taking initiatives in order to inform their school community with respect to the protection of the marine environment and healthy oceans.

A probe into in-service teachers' perspectives and pedagogies for marine education in Taiwan

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This report shares preliminary results about marine education in Taiwan. In Taiwan, marine education has been carried out as one of mandatory agendas in senior high and elementary schools from 2011. Since this marine environmental project will design professional development program in the near future, it is needed to explore teachers' perspectives about related educational policies, and their demands for support and ideas of pedagogies in implementing marine education. A total of 103 questionnaires collected from in-service teachers have been analyzed. Most participants were motivated by contents of the training courses and personal intention to pursuit of new knowledge. As for recognition for marine education policies, most participants showed preliminary understanding. Comparison of participants from marine education center schools and non-center schools reveals no significant difference, as far as recognition for marine education policies is concerned.

Oceanography-themed museums were favorite choices when participants looked for assistance to carry out marine education. When asked what kinds of resources were in need to support future implementation of marine education, "professional oceanographic knowledge" was the top concern, and "rationales and policies of marine education" fell behind in the ranking, meaning participants' ignorance of this aspect. Among the content items of marine education, "environmental protection and ecological conservation" along with "ecotourism" were considered most feasible, while "marine laws and policies" as well as "marine physics and chemistry" were least feasible according to the participants' consideration. Nearly three quarters of participants preferred lectures and outdoor activities. They were experienced at using visual aids such as PowerPoint slides for lectures. In contrast, scientifically related

pedagogies were less commonly mentioned. They rarely carried out scientifically related activities such as making authentic investigations and designing science exhibitions. In sum, participants' understandings about marine science/technology and marine law/policy were insufficient, which demands for more efforts for the future teacher professional development in this regard.

Canadian Network for Ocean Education (CaNOE)

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The ocean is important to Canadians culturally, environmentally, and economically – yet low levels of ocean literacy have been identified in Canada. The Canadian Network for Ocean Education (CaNOE) is a new organization that aims to advance ocean literacy by connecting individuals and groups engaged in marine education across the country. Though current ocean education initiatives in Canada are doing excellent work, they are predominantly uncoordinated and insular, leaving a need for a unifying body. CaNOE's mission is to act as a platform for dialogue, sharing, and learning among marine educators and scientists while supporting Canada's international responsibilities in advancing ocean literacy. Since its inception in 2014, CaNOE's online presence and outreach at both national and international conferences have attracted a membership of over two hundred individuals. A priority exists to ensure equal national representation, and current outreach initiatives strive to draw members from Central and Northern Canada. In June 2015, CaNOE will host the First Ocean Literacy in Canada Conference & AGM in Vancouver, British Columbia. A poster at EMSEA is an opportunity for CaNOE to provide an overview of the current ocean education landscape in Canada and celebrate the success of the network in its first year of existence. Presence at EMSEA would allow CaNOE to learn from others who have experience with ocean literacy networks. Ultimately, CaNOE would also like to engage in a dialogue with EMSEA to see how we can benefit one another as we work toward a more ocean-literate society.

Disclosure of two oceanic education initiatives performed in two Brazilian cities

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The Working Group Discovering the Oceans-GTDO was formed for the purpose of promote the education of the oceans by the Brazilian academic community from pre-school level to

the middle level. The initial commitment of the GTDO members is to promote the principles of "Ocean Literacy" in the school community. The goals of GTDO are disclose ocean education initiatives what being carried out; create specialized courses that contemplates these principles, and build an electronic portal with educational materials and information about scientific events. In a first step members of the GTDO visited two oceanic education initiatives. The initiatives visited were the Boat School Ark of Knowledge, and Sea School. The Boat School Ark of Knowledge is a project developed in the city of Bertioga, State of Sao Paulo, it is an initiative of the City Hall, who works environmental education This project is one class held on a boat, which sails for two hours in Bertioga Channel, exploring themes linked to the environment, the mangrove ecosystem and history of Brazil. The Sea School project is promoted by the municipal government of Florianopolis-SC, and aims at creating experiences, establish relationships and preserve the environment, working marine education and coastal in the region, and implement digital inclusion initiatives and training in entrepreneurship for mariculturists and artisanal fishermen and their families. Both initiatives visited by GTDO members are projects managed by municipalities, and the target audience is the school community, and prioritize of oceans education an interdisciplinary manner. Disseminate initiatives promoting of oceans education is a form of advertising, and incentives for what in the future, all the municipality can have a place to discuss and perform multiplication actions of knowledge about the oceans.

Kit do Mar: Promoting Ocean Literacy through Engagement of Teachers and Students

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Kit do Mar has been promoting ocean literacy among children and youngsters ever since its inception in 2008. What started as a collection of educational worksheets about the ocean, evolved into a much larger project that also comprises activities, training sessions and programs. Coordinated by EMEPC, Kit do Mar reaches schools from all over Portugal, getting an estimated 250000 students to be more informed and socially aware of the importance of the ocean in all its different dimensions.

We have developed practical training sessions focusing on ocean-related topics (extension of the continental shelf, marine litter, sustainability, ocean resources, deep sea, ocean technology, marine protected areas). While some of these are directed for students and implemented in the classroom, others are conducted for teachers and educators. There is a need to provide quality resources to educators at all levels (Payne and Zimmerman, 2010) but, from our experience, their active engagement is even more important. We provide them with knowledge, resources and ideas on how to implement ocean subjects. Most of these teachers go on to develop projects about the oceans with their students, where it is clear how positively influenced they were by these training sessions.

Our action towards ocean literacy is also achieved through the execution of programs with other institutions. "Bridges Between School and Blue Science" allows the engagement of high school students in authentic marine science research environment. "West Takes Portugal to the World" is a transatlantic educational project that allows the interaction between schools through the monitoring of a miniature sailboat that sails across the ocean.

All these actions make Kit do Mar a “stronghold” of ocean education in a country that is at the forefront of ocean literacy in Europe. Every project and action we perform is correlated with the national curriculum and ocean literacy principles.

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Ways to promote ocean literacy in informal education. Examples from the NMFRI Gdynia Aquarium.

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The Education Center of the Gdynia Aquarium, started in 1998 by the National Marine Fisheries Research Institute (NMFRI), is the biggest informal ocean education establishment in Poland. The Education Center staff are biologists, oceanographers, chemists, environmental protection specialists and promotion specialists. The knowledge given to our recipients is based on the knowledge gained from the scientific research of the NMFRI, which is the governmental advisory body in marine politics in Poland. Almost 40 thousand students of all age take part in our classes annually. Events promoting the knowledge on seas and oceans are a part of the educational activity and are organised monthly. We put an effort to implement standard teaching techniques (workshops, laboratory classes, lectures) as well as modern ones (electronic guides, education through play, social media). We understand that the student’s curiosity depends upon the commitment of the teacher. To fulfil a quest of passing the idea of ocean literacy, as educators we need to keep improving our practices and follow the dynamic social preferences continually. Accordingly, the success of marine educator’s work is related to variety of used methods, appropriate for the recipients’ age. International as well as regional cooperation and practice exchange is crucial for new ideas. Therefore, we would like to share and discuss our experience as educators. The proposition for the EMSEA 2015 poster display would provide sketch and analysis for available and used methods of teaching about the oceans, on example of the NMFRI Gdynia Aquarium.

Snorkeling path – A green tool to reconnect the new generation with the sea

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Snorkeling is the practice of swimming on a body of water while equipped with a diving mask, a shaped tube called a snorkel, and fins. Use of this equipment allows the snorkeler to observe underwater life for extended periods of time with relatively little effort, advanced safety and cost effective. The primary appeal is the opportunity to observe underwater life in a natural setting without the complicated equipment and training required for scuba diving. It

appeals to all ages because of how little effort there is. Nowadays, the reconnection of the new generation with the nature it is more urgent than ever, as the new technologies, the growing needs on activities and new knowledge (sports, foreign languages, musical knowledge) cut down important time from the children for the connection with the nature, in this case from the exploration of the sea, even during the summer period. The implementation of a snorkeling path on a beach, where both locals and travelers spend time, is a low cost investment that the local municipal or a nearby hotel can do in order to provide to the citizens and travelers an important activity. Shallow waters (depth <5m) and the existence of rare species and habitats with a conservation status (as an example the endemic bivalve *Pinna nobilis*, and the endemic seagrass *Posidonia oceanica*) as well as interesting seascape formations can drive to the selection of the paths. After the implementation and when the citizens and the travelers try them, the demand for a healthier coastal environment will increase and thus citizens will/can act as scientists and support decision makers and scientists for actions for a better marine environment. Also, the new generation will have the opportunity to reconnect with the sea and to explore the hidden gems in front of its town.

See Shore Scotland/Kenya; A pilot project to promote global marine citizenship through primary school partnership

Pye S.

National Museums Scotland

The aim of this project is to link up coastal primary schools in Britain and overseas to raise awareness of marine issues on a local and global scale. For the pilot project one school in Scotland and one in Kenya were selected. The schools, the participating children and their local marine environments are very different and it is these differences that the project seeks to draw on.

The children were taken to the shore to see what was there and to share their findings with one another. Details of the project are presented alongside an effort to evaluate the success of the project in Scotland. Problems with infrastructure and resources, particularly in Kenya meant the project was of less value to the Kenyan children than the Scottish children. Another partnership is proposed where both sets of children have similar levels of resources available.

From ocean literacy to environmental awareness: new teaching activities on marine micro-plastics

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While teaching activities on marine litter have quite a long tradition, the topic of marine micro-plastics is a relative new issue in education.

In fact one of the first papers on micro-plastics was published in 2004¹, sparking the interest of researchers, who eventually discovered them in nearly every environment. In addition, since micro-plastics are ingested by zooplankton, they also enter food webs: a type of marine pollution yet to be assessed thoroughly.

Inspired by this issue, we developed a series of practical activities for students of different age, which have been presented to 19 students' groups between November 2014 and June 2015. The activities were evaluated through questionnaires given to class teachers.

For younger students (age 3-7) we address the topic of micro-plastics bioaccumulation in marine food chains by means of micro-plastics models (built from plastic bottles) and a performance in which some pupils act as fish of different size and rank: the biggest one ends up as a "meal" shared by other pupils. Teachers guide the performance, play other characters (a fisherman, his wife) and stimulate observations and remarks about the origin of micro-plastics and the correct management of plastic objects.

For students aged 8-16 the activity begins with observation and manipulation of common household plastic objects, aimed at understanding plastic characteristics that make these materials valuable and troublesome at the same time.

The fate of plastic objects is then addressed by the observation of beach litter and of beach sand containing natural components and man-made fragments, including micro-plastics observed through a lens, followed by videos on the consequences of plastic litter for marine organisms.

Finally we introduce primary micro-plastics presenting personal care products containing micro-beads: students touch and observe them, then discuss the correct habits to solve the problem of marine micro-plastics pollution.

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Global Ocean Science Education: Results from the First International Workshop

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¹*University of Rhode Island*

²*College of Exploration*

It is imperative for ocean science education to be closely linked to ocean science research. This is especially important for research that addresses global concerns that cross national boundaries. The results of research on these critical ocean issues must find its way to the public, educators, and students of all ages around the globe. To facilitate this, opportunities are needed for ocean scientists and educators to convene and identify priorities and strategies for ocean science education. On June 26 and 27, 2015 the first Global Ocean Science Education Workshop was convened in the United States at the University of Rhode Island Graduate School of Oceanography. The workshop, sponsored by the Consortium for Ocean Science Exploration and Engagement and the College of Exploration, had over 60 participants representing 15 nations. The workshop addressed critical global ocean science topics, current ocean science research and education priorities, advanced communication technologies, and leveraging international ocean research technologies. In addition, panels discussed elementary, secondary, undergraduate, graduate, and public education across the ocean basins with emphasis on opportunities for international collaboration. Special presentation topics included advancements in tropical cyclone forecasting, collaborations among Pacific Islands, ocean science for coastal resiliency, and trans-Atlantic collaboration. This presentation will focus on workshop outcomes as well as activities for building a global ocean science education network. A summary of the workshop report will also be provided.

Innovative Pedagogical Practices in Biology Higher Education

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Biology is highly relevant to everyday life. Some of the world's most pressing concerns such as feeding the global population, coping with climate change, preserving ecosystems and biodiversity, curing and preventing genetically based diseases rely heavily on biologists. It is expected that the new generation of biologists think critically, solve problems creatively, innovate, work interdisciplinary and in teams, learn ever-changing technologies, deal with a flood of information and communicate through many different media to a wide range of audiences. The Center of Excellence in Biology Education (bioCEED) at the department of Biology (BIO) at the University of Bergen (Norway) is proceeding to an educational reform to prepare students to enter at the best the workforce as biologists.

In this study, we describe innovative pedagogical practices held at BIO at bachelor and master level. We are defining this approach as “learning for doing and doing for learning”.

For learning, students are “doing the work” within biology, in the industry, research and public sector. The “doing” of the students will be beneficial directly to the society (public sector taking decisions based on student’s scientific results), while the society’s needs are directly impacting the learning content of the students. Besides of curricula’s enrichment, students are invited to develop their communication skills. They present their work to different audiences, such as public servants, engineers, scientists or citizens, and they use a combination of media such as reports and blogs, as well as oral communications including artistic collaboration.

We are evaluating the impact that these practices have on students’ motivation, success in finding their first employment and on their future involvement in the societal challenges.

If this evaluation reveals that the students are better prepared to meet the demands of the new generation of biologists, we aim to develop and spread these pedagogical practices further.

From the Research Project to the Class Room: I. Translating Complex Science into Simple Experiments

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At GEOMAR and Kiel University, the Collaborative Research Centre (SFB 754) funded by the German Research Foundation, deals with climate-biogeochemistry interactions in the tropical oceans and the threat of ocean de-oxygenation. Part of this research project is a school outreach programme, which aims to introduce pupils to the science behind the formation of oxygen minimum zones (OMZs) in the tropical oceans.

To realise this, several methods have been employed. Initially, the school outreach focused on science video production. Pupils in upper secondary schools (grades 9 – 13) made videos for fellow pupils about specific topics like eutrophication, nutrient cycles in the OMZs or methodologies used by scientists to study OMZs. Gradually, the focus shifted to the development of simple experiments to explain the complex processes going on in OMZs. Using Luer-Lock plastic syringes, for example, students learn the principles of oxygen solubility in liquids. For older pupils, nutrient cycles and bacterial oxygen consumption are demonstrated using immobilised microalgae, bacteria and sediments.

The experiments are developed on the basis of easy-to-use and re-usable materials affordable within the schools’ limited budgets. They are easy to follow and understand, and they are integrated into GEOMAR’s programmes for schools (cf. Poster II). To transfer these experiments to the schools’ permanent fund of resources, they are introduced in teacher-training events and made available free of charge.

What is Ocean Literacy? – Animation developed for the Sea Change Project

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2. European Marine Board, Belgium

The aims of Sea Change are: *‘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’*. One of the first deliverables of the project was to produce a fun and engaging animation to explain, to a broad audience the meaning of Ocean Literacy.

If someone asked you, “are you ocean literate”, you might say “Ocean... what?!”

Ocean literacy is about understanding how the ocean influences you and how you influence the ocean.

Every second breath you take connects you with the ocean because half of the world’s oxygen is produced by phytoplankton, microscopic plants drifting with ocean currents. Take a breath and about it.

But that's just the start. The ocean is an important source of food, and freshwater and regulates our climate by transferring heat across the globe.

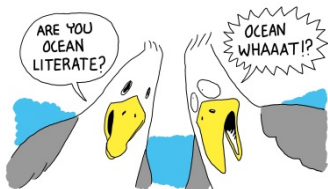
The ocean has always connected people, goods and ideas around the world and been a source of inspiration and fun.

Many people make a living from the ocean.

Until recently it was thought that the ocean was so vast that humans couldn’t possibly influence it. Now we know better. Together, we all impact the ocean by what we put into it and what we take out of it.

By being ocean literate, we can make choices that are more ocean-friendly and therefore better for us too.

So, wouldn’t it be great if more people were ocean literate?



Click on the link to view the animation <https://vimeo.com/139562761>

Fit for Purpose – the changing face of an ageing research institute

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The former University Marine Biological Station in Millport is amongst the oldest centres for marine research in the world. The station began its life as an 84 foot floating research laboratory, The Ark, brought to the Clyde Sea in 1885; which led to the construction of a permanent research station on Cumbrae. From its opening in 1897, just three years before the unfortunate sinking of The Ark, the facility steadily grew to include multiple laboratories and teaching spaces, a dive unit and two research vessels, along with research and public aquaria and a museum. Over its 130 years, the Marine Station was an important centre for research into marine physiology, fisheries, and pollution, and one of the principal destinations for university courses in marine biology.

Following the closure of the Marine Station by the University of London in 2013, the facility was reopened by the Field Studies Council, who began a £4 million project to modernise and enhance the site. In addition to continuing the tradition of university teaching, the FSC has sought to attract a wider range of groups to the new facilities on Cumbrae. Courses for younger learners offer an opportunity to explore the local environment and its history, while schools groups benefit from direct links between the marine environment and curricular activities; in addition, leisure learning courses place the topics of history, biology and geography into the context of the Clyde Sea. Staying true to the original Marine Station's role in marine science and exploration, the centre offers research facilities for universities and environmental professionals. The museum and aquarium also remain to promote the work of local researchers and the importance of marine conservation to visitors to the island, a marker of the station's history of discovery.

Wild Beach Programme

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Our Wild Beach programmes have given young people an unrivalled opportunity to explore and connect with the marine environment. Following the Forest School approach, groups of children have visited their nearest beach every week for a minimum of a six week programme. We believe in learning through activity and direct experience, encouraging children to be curious and creative and to develop skills.

We have had excellent feedback from Wild Beach sessions. One teacher said: *'The Wild Beach project was absolutely fantastic. The children got a phenomenal amount from the sessions. Now they see the beach as far more than just a lot of pebbles and some water; from being able to tell the tides, to the coastguards, to the local fisherman, to seeing their home beach from out at sea. Many children had not experienced the beach in this way before and it opened up their eyes to so much, unforgettable learning. The tactile approach allowed pupils to independently learn, guided by experts and their knowledge and understanding of their local area grew dramatically. I thought the wild beach experience helped raise the overall attainment of the children in other curriculum areas. They have gained a lot of enthusiasm,*

as have I, which shall allow us to continue our outside learning of our environment. For the children, who will no doubt pass their experiences on to cousins, friends, family... it will genuinely change their lives forever.'

In the Wild Beach fieldtrip, you will have the opportunity spend a day on the beach and experience a Wild Beach session for yourself. We will facilitate a range of engaging activities we use to get participants learning about the marine environment. Be prepared to get your feet wet, get sand between your toes and have fun!

Ocean Literacy; challenging youngsters

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To enable ocean literacy in adults we have to start with kids as young as possible and build with them as they grow. They need to, and are, introduced to the marine world at a very young age normally through emblematic species such as starfish, dolphins, sharks, fish, whales, seals; some cuddly species, some protected species, mostly through idolized forms; happy, furry, cuddly and smiley. The harder education comes with putting those species into a context such as habitat, ecosystem, fishing, and conservation. We have a small approach to engage young children when they are already in a contextual surrounding; at an aquarium, a marine event such as Ocean Day, Clean Beaches, and Researchers' Night. We use word puzzles, marine related words hidden in the shape of marine species; find the missing words, where the words are context or the marine species. These are distributed free; a simple printed piece of paper, a pencil and a flat area to work are all that is needed. The children need to find the hidden words amongst the jumble of letters; it's good for ages from 7-14 and only takes a few minutes. A helpful adult may also try to further emphasize the context; why those words may be important to those species. Some association will stick and that is what we are hoping for. We also use these word games to disseminate some of our on-going research programmes including DEVOTES, BENTHIS, ODEMM and CoralFISH. Simply done for over five years (and hundreds of youngsters), a small but simple tool/step towards ocean literacy.