

# ORAL PRESENTATION

## ABSTRACTS

### Think like a scientist

Brock, EB.  
University of Gothenburg

"Think like a scientist" - A novel methodology for science education!

Our SSC workshops will stimulate interest in, and promote the importance of, natural sciences. Participants are high school students, but we also give workshops for educators from kindergarten to high school graduating levels.

#### What we do

The SSC methodology guides the participants into using their own ideas in order to perform a scientific study

Participants at the workshop will explore the world of natural science and practice scientific skills while performing hands-on studies in the field.

They will experience how biology, chemistry, physics and math go together

#### How we do it

Participants will practice scientific thinking according to a protocol used by scientists.

Participants work in the field at the Lovén Centre Tjärnö, a marine laboratory with international research projects.

Participants form hypotheses, perform experiments, interpret results and write a report of their study, which they present at a seminar.

Scientists act as supervisors and are involved in a dialogue with the participants and guide them into scientific thinking.

The process will enhance creative thinking and encourage the participants to pursue their own thoughts, questions and ideas.

The work will lead to a greater understanding of how different aspects of natural science go together.

The methodology will further add to co-operation between education and research.

### How do we get the ocean into classrooms?

Buchanan-Dunlop, J.  
Digital Explorer

There are two routes to giving the ocean its rightful place in the classroom - curriculum reform and supporting teachers. There is a view that teachers not governments create curricula and Digital Explorer has focused on this approach. Jamie will share his experiences of setting up the Oceans Academy ([oceans.digitalexplorer.com](http://oceans.digitalexplorer.com)), and education programme that supports teachers through training, resources, workshops and live links to ocean researchers. The content is based on research undertaken by scientists and explorers as part of the Catlin Arctic Surveys (2009-2011) and the Catlin Seaview Surveys (2012- ), investigating the worlds' coral ecosystems.

## **Life Adrift – teaching marine science using plankton**

Buckland, CB.  
SAHFOS

Sir Alister Hardy Foundation for Ocean Science (SAHFOS) runs and maintains the Continuous Plankton Recorder (CPR) survey. This remarkable survey is the longest running of its kind and has sampled over 6 million miles of oceans since 1931.

Studying plankton allows us to better understand a host of marine environmental and socio – economic issues, such as food web interactions, photosynthesis, the effects of climate change, ocean acidification, pollution and the effects of overfishing.

SAHFOS have been developing their knowledge exchange and outreach for many years and have a number of resources that can be utilised by students (of all ages), teachers and the general public. SAHFOS science policy insures that scientific research is translated into interesting facts, media publications and engaging resources.

This presentation will illustrate the importance of plankton to better understand the marine environment, and demonstrate some of the resources SAHFOS has developed enabling plankton to be used across many scientific subjects.

## **Virtual Marine Scientist**

Fauville, G., Dupont, S., von Feilitzen, M. and Säljö, R.  
University of Gothenburg

The Virtual Marine Scientist project from the University of Gothenburg aims at inducting secondary school students into the concrete manners in which scientists' work and research is carried out. In this project students learn how to design and run experiments in environmental science in a virtual environment.

When entering the Virtual Marine Scientist platform the students become a new PhD student working in a lab focusing on marine environmental issues. First the students learn about the impact of marine global changes on keystone species such as mussels. In the next step, students formulate their own hypothesis and apply for funding to run an experiment in order to test their hypothesis. When their teacher have reviewed and accepted their application, they can start designing their own experiments, deciding how many aquaria to use, what environmental parameters (e.g. temperature) to test and what species to study. They also select the parameters to measure (e.g. respiration, growth) and to what frequency, while needing to respect their allocated budget. Then the students receive the data from their experiments. They leave the virtual environment with a set of data corresponding to their own designed experiment, which will then be analysed and discussed in the classroom with the peer students and the teacher. Finally, the students will present their findings to their class.

The project will serve as empirical material to investigate the impact of virtual resources in environmental, marine and science education. The following research questions will be addressed: How can virtual labs be integrated into teaching (major affordances and obstacles)? Do students using virtual labs succeed in mastering principles of experiment work? To what extent do students learn about the relevant scientific concepts in environmental science in a virtual setting?

To address these questions, quantitative (analyze of assessment and lab report) and qualitative (interviews, observation) methods will be used.

## **The development and delivery of a NE maritime curriculum.**

Gebbels, S and Russell, A

There are concerns from community leaders, politicians and educationists that pupils are disengaged with community issues and unaware of their built, natural and heritage environments. The case for a curriculum designed by individual schools which reflects and focuses on an area's cultural and environmental heritage is a compelling one as it engages young people with the neighbourhood around them. Researches from the Dove Marine Laboratory (Newcastle University) developed a marine focused regional curriculum in a pilot study during 2013 with 3 NE primary schools. The researchers took the topics that the schools were teaching during the spring term (Ancient Greeks, Habitats and Our Environment) and developed complimentary activities and resources that utilised and celebrated the schools coastal locality. The results showed significant increases in knowledge and positive changes in attitudes towards locality and community and the marine environment.

Feedback from teachers and head-teachers was encouraging. Staff reported an increase in their confidence to take children to the coast, new ideas for creative lessons and the positive impact of the project across the school. This presentation gives an overview of the project from its development, through to the next phase-a second pilot study with middle and secondary schools.

## **Incorporating Ocean Literacy into the Learning Strategy of the Titanic Belfast Visitor Attraction**

Heaney, S. and McCartney  
Titanic Belfast

The current drive to increase levels of ocean literacy across Europe provides a wealth of exciting opportunities for both traditional and non-traditional educational establishments to become involved in this ambitious project. Non-traditional educational institutes such as museums and aquaria have been cited as the 3rd most popular source of ocean literacy information after schools and television. The footfall through these types of businesses presents a massive audience with optimal opportunity to educate, engage and inspire these visitors.

Titanic Belfast is the world's largest Titanic visitor attraction which is located in Belfast, Northern Ireland and since it opened its doors in March 2012, has welcomed over 750,000 through its doors, including tens of thousands of school children. Titanic Belfast contains a unique gallery known as the Ocean Exploration Centre as part of the visitor experience. This space is dedicated to disseminating information about contemporary methods of ocean exploration and current developments in marine science on both national and international levels.

Education is one of the core values of Titanic Belfast and the range of the current learning programme covers many aspects of primary and secondary schools curricula for both Northern Ireland and the Republic of Ireland in addition to introducing the principles of ocean literacy to these markets.

This presentation will discuss the multi-faceted approach taken by Titanic Belfast to introduce ocean literacy via formal and informal education workshops, seminars, lectures and some of the other methods utilised in order to inspire the next generation of "Titanic Thinkers" and nurture a sense of citizenship within each of our guests by creating an awareness of the importance of our ocean and the necessity of its protection.

## How to Create Marine Outreach Programmes that Work

Joyce, JJ.

By carefully researching the needs of both teachers and pupils and by using a 'hands-on approach', as well as the universal medium of cartoons to convey information, it is possible to create practical marine outreach programmes that not only comply with the requirements of the local primary school curricula but are also fun for those taking part. This paper draws on lessons learned from the 'Explorers' Primary School Marine Education Programme developed by the Marine Institute in Ireland and more recently from the Black John the Bogus Pirate - Cartoon Workbook of Marine Beasts, which was successfully demonstrated to over 2,000 budding Irish artists and marine biologists in 2012.

## The Micro B3 Project: Marine Microbial Biodiversity, Bioinformatics and Biotechnology including the Ocean Sampling Day initiative

Klindworth, A.<sup>1</sup>, Field, D.<sup>2</sup>, Bicak, M.<sup>2</sup>, Wesnigk, J.<sup>3</sup>, Kottmann, R.<sup>1</sup> and Glöckner, FO.<sup>1</sup>

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<sup>3</sup>Environmental & Marine Project Management Agency, Bremen, Germany

Micro B3 ([www.microb3.eu](http://www.microb3.eu)) is a large EU FP7 research project on marine microbial biodiversity, bioinformatics and biotechnology. 32 partner institutions from 14 countries form teams of experts in bioinformatics, computer science, biology, ecology, oceanography, bioprospecting, biotechnology, ethics and law. This multi-disciplinary consortium across Europe aims to make vast amounts of data from marine microbial research available for better environmental modelling and innovative biotechnological applications. At its core Micro B3 aims to develop an innovative, transparent and user friendly open-access information system as well as a legal framework for genome-based environmental research. This will in turn offer new perspectives for the modelling and exploration of marine microbial communities for biotechnological applications (Teeling H 2012).

A key boost to Micro B3 will be provided by the integrated Ocean Sampling Day (OSD, [www.oceansamplingday.org](http://www.oceansamplingday.org)), scheduled to take place on the summer solstice, 21 June 2014. OSD will run worldwide, with pilots conducted in 2012 and 2013 to develop and test standardized sampling techniques. (Meta)Genomic data from cumulative sampling will be related in time, space and with the help of contextual environmental parameters. This approach will provide insights into fundamental rules describing microbial diversity, ecology and function and will contribute to the blue economy through the identification of novel, ocean-derived biotechnologies. To ensure maximum usefulness, standards for sampling and data analysis will be established within Micro B3. They are based upon agreed best practices to ensure a high level of consistency for the OSD and future environmental genomic sampling. In particular all sites will be expected to comply with the "Minimum Information about any (x) Sequence" (MIxS) Checklist of the Genomic Standards Consortium (GSC, [www.gensc.org](http://www.gensc.org)) (Yilmaz P 2011). We expect that the combined data will provide a reference data set for generations of experimentalists to come. OSD should also function as a starting point and integrative part of site-based monitoring of microbial communities as

proposed by the Genomic Observatories ([www.genomicobservatories.org](http://www.genomicobservatories.org)) initiative (Davies N 2012). An open call to participate at the Ocean Sampling Day is launched to invite external participants across Europe and beyond. Furthermore, a citizen science campaign for OSD is planned for October 2013 to involve the non-scientific community in the OSD and to raise awareness of the fascinating marine microbial world.

In summary Micro B3 with its OSD initiative is set to significantly improve Europe's capacity for bioinformatics and marine microbial data integration, to the benefit of a variety of disciplines in marine science, biotechnology, computing, standardisation and law. Several training courses, dissemination and outreach workshops are providing interdisciplinary knowledge transfer and education for stakeholders from industry, policy as well as for scientists.

Micro B3 is financially supported by the FP7 Ocean of Tomorrow Grant #287589.

Davies N, M. C., Gilbert JAS, Amaral-Zettler L, Deck J, Bicak M, Rocca-Serra P, Assunta-Sansone S, Willis K, Field D (2012). "A call for an international network of genomic observatories (GOs)." *GigaScience*1(5).

Teeling H, G. F. (2012). "Current opportunities and challenges in microbial metagenome analysis - a bioinformatic perspective. ." *Briefings in Bioinformatics*13(6): 728-742.

Yilmaz P, et al. (2011). "Minimum information about a marker gene sequence (MIMARKS) and minimum information about any (x) sequence (MIXS) specifications." *Nature Biotechnology*29(5): 415-420.

## WHY DOES THE SEA FOAM?

Chiroutre, E.<sup>1</sup>, Martinez Vicente, V.<sup>2</sup> & Keizer, T.<sup>2</sup>  
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Why is there so much foam on the beach and what is that stinking smell? How do these large amounts of green algae end up in my fishnets? Why do we speak about 'Death Zones' in the sea and how do they arise? Why are certain cultured mussels not suitable for consumption? Why is this happening now?

To answer all these questions, scientist from various institutions and research disciplines are united in a European project called ISECA (Information System on Eutrophication of our Coastal Areas).

Eutrophication is one of the main causes of the deterioration of water quality. In the North Sea and the English Channel, this phenomenon is related to two major activities: agriculture and industry. Such environmental problems not only have an effect on life in the water but also on the coastal zone and its economic activities (i.e. tourism, recreation, and environment). The eutrophication problem has been extensively discussed in the EU Water Framework Directive and the OSPAR Convention of 1992. Both Conventions aim to introduce a good management of our rivers and coastal waters. In order to achieve the environmental objectives set by the legislation, coastal water quality must be monitored. There are already several monitoring programs that cover small portions of the European coastal areas. ISECA wants to extend this monitoring through use of Earth Observation, and become an important tool to inform authorities and stakeholders (agriculture, industry, tourism), so that action can be taken in near future.

Therefore, a large focus of the project is to explain to the public at large what eutrophication is, its consequences and the scientific basis of the monitoring techniques. The presentation will provide an overview of the project, the innovative educational and scientific tools developed including here in Plymouth, and future challenges.

## **Pre-service teachers' knowledge of ocean science issues in Greece**

Mogias, AM, Boubonari, TB., Markos, AM. and Kevrekidis, TK.

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It is widely accepted that the ocean defines almost everything on our planet, and therefore understanding its role, is essential to comprehend the planet upon which we base our well-being. The need for achieving high levels of ocean literacy, if we wish to take informed decisions and lifestyle choices which affect aquatic environments, is getting more important than ever nowadays. Considering the pivotal role of classroom teachers as important change agents in shaping environmental literacy of future generations, the present study analyzed the underlying factors contributing to ocean literacy and reasoning of 421 prospective primary school teachers in Greece. A 54-item survey instrument, aligned with the seven essential ocean literacy principles and the corresponding fundamental concepts, was used to measure respondents' understanding about ocean science issues. Item response theory was used to refine and validate the instrument as a reasonable measure of ocean content knowledge. Results revealed relatively low to moderate levels of content knowledge, which could be mainly attributed to the lack of integration of ocean issues into both formal education and teacher training curricula; furthermore, this is in line with the finding that the internet and mass media were indicated as the primary information sources for the participants to acquire knowledge on ocean issues. In conclusion, the study highlights an urgent need for reorienting teacher preparation programs in Greek Universities toward more emphasis on educational practices, which can establish a more meaningful and confident engagement with ocean issues.

## **MarineArt as part of a SHOCK therapy.**

Seys, J.  
Vlaams Instituut voor de Zee

Basically the concept of (reinforcing) ocean literacy is dealing with how to better share ocean knowledge among scientists, educators, policy-makers, citizens. It has become clear that, in order to get more ocean awareness to face the challenges of the future, we need a SH(aring) OC(ean) K(nowledge) therapy. This SHOCK therapy should possibly work along the 9 main principles/mechanisms that have been identified at the occasion of the First Conference on Ocean Literacy in Europe (Bruges, 12 October 2012). These 9 principles/mechanisms are: (1) identification/implementation of essential principles of ocean science; (2) a holistic/inclusive process of involving formal/informal education and creating more interaction/collaboration between educators, scientists, the public, etc.; (3) a strategy/reflection on how to make outreach more effective; (4) active involvement of aquaria, museums & science centers; (5) baseline studies on ocean knowledge, on how people feel about the seas & on what they want to know; (6) use of all the senses, including ocean documentaries and other visuals as very strong instruments; (7) make the public understand the societal benefits of the ocean; (8) use of new technologies (observation; new media; ...); (9) citizen science.

As an inspiring example of citizen involvement with marine science, the MarineArt project will be illustrated in some more detail. In this project, more than 1000 Belgian kids, teenagers and adults attending art classes during their free time, were confronted with marine science. The process involved more than 50 lessons and workshops organized by marine scientists at universities on diverse aspects of the marine environment, and an extensive interaction between the artists and the scientists. The final product was an exhibition of a huge number of pieces of art (paintings, sculptures, animations, etc.) inspired by ocean knowledge. Even more than the exhibition and the resulting pieces of art, the process in itself proved to be very fascinating and inspiring. Although the project had virtually no finances, initially started as "just an idea" and simply floated and exploded based on a growing enthusiasm, it has proved to be extremely successful.

Since the Bruges conference, some progress has been made in drawing a strategy for more ocean literacy in Europe and for a further transatlantic cooperation in this field. An open-ended "Ocean Literacy in Europe consortium" has been formed consisting of representatives of EMSEA, the

European Marine Board and its communication panel MBCP, the World Ocean Network (WON), the Marine Biological Association (MBA), the Flanders Marine Institute (VLIZ) and the University of Gothenburg. Invited by the European Commission (DG Research), the group has worked on three major questions at the occasion of a dedicated Ostend workshop (25-26 June 2013) with an invited list of experts: (1) How to upgrade evaluation criteria for Horizon2020 in order to make the outreach of new projects more effective?; (2) What could be the key transatlantic issues and actions relevant to ocean literacy which will require EU-North American collaboration?; (3) Which marine scientific topics could be highlighted for dedicated "outreach" efforts within Horizon 2020 and in a transatlantic context? The results of this exercise will be presented.

### **Transatlantic Experiences Connecting Marine Science, Ocean Education, and Exploration**

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What do Portuguese ocean literacy efforts, a historic U.S. shipwreck, and an autonomous underwater vehicle have in common? They are all transatlantic initiatives that the College of Exploration has been involved in. In this session, we will present case studies of cooperation in ocean research, exploration, and education. U.S. and E.U. non-profit organizations, government, education institutions, science organizations, and the military have been involved in these programs.

These projects have brought cutting edge marine science to educators around the Atlantic and beyond by using online technologies for learning and community-building. They have used a variety of media to communicate, educate, study and engage scientists and educators.

Portugal's premier science and technology organization, *Ciência Viva*, conducted hands-on teacher professional development workshops in ocean science. They introduced the Ocean Literacy principles and adapted them for Portuguese educators.

A multi-year search for a historic U.S. shipwreck is underway with partnerships between the non-profit Ocean Technology Foundation, and the U.S. and French Navies. Ocean literacy is a life-long endeavour and the technologies used in the search for the *Bonhomme Richard* offer learning opportunities and cultural exchange between FR and US Navy and civilian personnel.

*Autosub Under Ice* was a programme from the National Oceanography Centre (NOC) at the University of Southampton. In partnership with NOC and the Natural Environment Research Council, the College of Exploration (USA), enabled educators and scientists around the world to learn more about the UK's under ice explorations and research.

These case studies offer models of Ocean Literacy in a European context, Marine Education in practice, and linking science with marine education in a transatlantic context. They are facilitated and managed by a team with a broad understanding and abilities in the inherent cultural and language challenges of working internationally.

**Bringing Northern Ireland's inhabitants to the lands edge, and then a little further.**

Whiteside, KW., McLean, LM. and Berman, JB.  
Ulster Wildlife Trust

In Northern Ireland no one lives more than 35 miles from the lands edge and within the Living Seas team we're trying to bring them to the edge, and then a little further. The current levels of awareness of our local seas is very low with only basic knowledge of the coastline and the creatures which live in our waters. This creates an even bigger challenge in trying to connect people with the environmental, social and economic value of the ocean and its potential for the future. So far we have engaged with over 3000 kids and adults in rock pool rambles, coastal walks, snorkel safaris, talks, demonstrations and intertidal surveys. However, it is crucial to understand which types of engagement are effective in changing attitudes and knowledge levels in the short, medium and long term. We are in the process of carrying out research into the effectiveness of formal and informal education and outreach methodologies for a range of audiences. We will be presenting the results of our gap analysis of suitable pathways for formal marine education along with the initial findings of our results from research into the current knowledge and attitudes of communities in Northern Ireland. We feel the ocean and the life within it, its intricacies, its value and its resources, should be part of every child's education and part of every adult's consciousness.



# POSTER PRESENTATION INDEX

Apostoloumi, CA. and Kevrekidis, TK.	Shaping Ocean literate students: Teaching proposal about biodiversity of coastal lagoons.	31
Baker, GB., Sewell, JS. and Mainwaring, KM.	MBA Education	31
Bradassi, FB., Cumani, FC., Riccamboni, RR., Dupont, SD., Fauville, GF. and Bressan, GB.	Experimental approach in virtual tools: E-CO2 School Lab.	32
Caroppo, C., Boero, F., Giostra, U., Giuliano, L., Papa, E. and Pugnetti, A.	The Facebook strategy as an interactive communication tool in the RITMARE Flagship Project	32
Costa, R., Silva, S.	"Teacher on Board" – Improvement in ocean science literacy through immersion in oceanographic cruises	33
Crouch, FC., Gibb, NG. and Mainwaring, KM.	The Shore Thing Project - Climate change monitoring by students and community groups	34
Crouch, F., Copejans, E. and Fauville, G.	European Marine Science Educators Association (EMSEA)	34
Dunn, J.	Development of outreach and marine education at Marine laboratory Aberdeen, over the last twenty years.	35
Fauville, G., Miller, P., Hodin, J., Thorndyke, M., Dupont, S. and Epel, D.	Ocean acidification in the classroom	36
Fleming, MF., McCauley, VMcC., Lenaghan, JL. and Grehan, AG.	Changing School Curriculums - an opportunity for Marine Education in Ireland	36
Gebbels, SG.	Using Skype as a teaching tool to bring International Marine Science into the classroom.	37
Gebbels, SG. and Russell, AR.	A pilot study of a regional curriculum focusing on ocean literacy	37
Geraldes, DA., Mata, B., Farinha, A., Drago, T. and Costa, R.	Bridges between school and blue science	38
Gerdes, AG. and Pätzold, MP.	Strategic Cooperation in Marine Education	38
Gordon, CG. and Richardson, JR.	Citizen Science in Shark Conservation	39
Grehan, AG., McCauley, VMcC., Lenaghan, JL. and Fleming, MF.	iBook Resources for Marine Education – Investigating Irish Coral Reefs	39
Hartley, BL., Thompson, RC. and Pahl, S.	MARLISCO: Engaging society to reduce marine litter	40
Lomax, AL. and Jones, BJ.	ORCA citizen science: public participation in offshore whale and dolphin ferry surveys.	40
Mc Closkey, RMC. and Johnston, EJ.	The use of shark research as a medium to educate coastal communities on sustainable marine resource management.	41
Milanese, Sarà, Previati, Rossetto, and Cerrano	About diving, science and education	41
Miller, A	The Ocean Explorer Centre – SAMS' new visitor and outreach centre in Oban, Scotland	42
Miller, P., Fauville, G., Hodin, J., Thorndyke, M., Dupont, S. and Epel, D.	International Student Carbon Footprint Challenge	43

# POSTER PRESENTATION INDEX

Murray, NM.	Learning at the National Marine Aquarium	43
Richardson, JR. and Gordon, CG.	The Shark Trust Angler Recording Project	44
Santoro, FS., Watson-Wright, WWW., Pissiersen, PP., Grimes, SG., Valdès, JLV., Fischer, AF. and Aarup, TA.	The Intergovernmental Oceanographic Commission of UNESCO: ocean literacy in action	44
Savage, SP.	One World One Ocean – A Cross Curriculum Approach	45
Scowcroft, GS., Vigness-Raposa, KVR., Knowlton, CK. and Morin, HM.	Discovery of Sound in the Sea: Resources for Educators, Students, the Public, and Policymakers	45
Smith, CJ., Sewell, J. and Guy, GJ.	Life around the turbines	46
Suarez, MS	Knowing the Ocean - a navigation chart for ocean literacy in Portugal	46
Tuddenham, PT.1 and Olivier, BO.2	The Atlantic and US (You and Me), Linking Ocean Science with Marine Education to Advance Transatlantic Ocean Literacy	47
Ward, MA.	Teaching A Level Biology on the rocky shore – past, present and future – a field studies council perspective.	47

# POSTER PRESENTATION

## ABSTRACTS

### **Shaping Ocean literate students: Teaching proposal about biodiversity of coastal lagoons.**

Apostoloumi, CA. and Kevrekidis, TK.  
Democritus University of Thrace  
Department of Elementary Education

This paper presents a teaching proposal, which utilizing new technologies, aims to shape Ocean-literate students. As an important part of the entire marine biodiversity is concentrated on coastal lagoons, this proposal, being a part of a comprehensive proposal about coastal lagoon biodiversity, aims to primary students understand the structure and function of coastal lagoon ecosystem, can communicate about coastal lagoons in a meaningful way, and be able to make informed and responsible decisions regarding coastal lagoons.

This teaching proposal consists of two units. In the first unit, with the multimodal and diverse presentation of information through incorporated software tools of Interactive Whiteboards, students get in touch with information concerning (a) the potential of coastal lagoons to provide important and productive nursery areas for many fish species, (b) about the categories of fish species (typical lagoonal, migratory marine/estuarine and marine fish species) that occur in Mediterranean coastal lagoons, and (c) the morphology, biology, and ecology of the most common and characteristic of these species. In the second unit, students discuss all together, fill up electronic worksheet and they evaluate their knowledge about fish fauna of the Mediterranean lagoonal ecosystem. Also focusing on the multiple natural functions of coastal lagoons and the values arising from these functions for the human being, students discuss concerning the issues developed and record their suggestions about actions that are necessary for the conservation of coastal lagoons.

As many positive results have been given when teaching sciences issues using new technologies, we expect that our teaching proposal with the suitable and correct utilization of new technologies can contribute to the gradual shaping of ocean-literate persons and to a more development of the Ocean Literacy in Europe.

### **MBA Education**

Baker, GB., Sewell, JS. and Mainwaring, KM.  
The Marine Biological Association of the UK

The Marine Biological Association (MBA) was set up with the aims 'To promote scientific research into all aspects of life in the sea, including the environment on which it depends, and to disseminate to the public the knowledge gained.' The education team seeks to ensure that there is an effective knowledge exchange system in place and as such it works locally, nationally and internationally on a diverse and innovative programme of education, communication and public engagement. The work of MBA Education ranges from organising seashore safaris, which allow members of the local community to connect with their blue spaces in a new and exciting way, to jointly running one year Masters courses with Plymouth University. The team have strong links with many schools across the UK and are regularly, providing curriculum-linked teaching resources, training in survey techniques and data collection as well as putting together 'fun' programmes for school activity weeks or offering their students the opportunity to undertake a week's work experience. Many other training courses and conferences are organised and offered through the work of MBA Education as well as regular events and surveys being arranged for the MBA members. Within MBA Education there are a variety of projects (Blue Sound, Shore Thing and Life Around the Turbines) which have more specific aims and target audiences. This work combined with the regular public outreach events has resulted in a very effective system of knowledge exchange working within the MBA.

## Experimental approach in virtual tools: E-CO2 School Lab.

Bradassi, FB.<sup>1</sup>, Cumani, FC.<sup>2</sup>, Riccamboni, RR.<sup>3</sup>, Dupont, SD.<sup>4</sup>, Fauville, GF.<sup>4</sup> and Bressan, GB.<sup>5</sup>

<sup>1</sup>Istituto Comprensivo Divisione Julia Trieste

<sup>2</sup>University of Trieste

<sup>3</sup>Divulgando srl

<sup>4</sup>University of Gothenburg

<sup>5</sup>OGS - Osservatorio Geofisico Sperimentale Trieste

Experimental approach is widely recognized to be the most effective method in science teaching, but lack of time and funds sometimes prevent its application.

E-CO2 School Lab is a virtual interactive laboratory for students from K7 to K12 dealing with Ocean Acidification Problem. E-CO2 School Lab offers three perturbation experiments based on reaction of calcareous red algae (Corallinaceae - Rhodophyta) in a high CO<sub>2</sub>-world. Students handle two virtual aquariums, the first representing actual condition, the second IPCC forecasted conditions for year 2100, taking several measurement of the algal growth and development. The Lab is supported by a large and multi-media miniWiki, where students can reach easily all information that they may need.

E-CO2 School Lab is a team-work: even though it can be played individually like a video-game, the real aim is to stimulate discussion about Ocean Acidification and its impact on marine ecosystem. The teacher, whose leading role remains fundamental, can tailor the experience on his/her class level and on demand (teacher's guide disposable on line.)

E-CO2 School Lab, available free on line, is proposed to meet the need of experimental teaching of science, with low time and fund investments.

E-CO2 School Lab was realized joining scientific and teaching skills of an international staff working in Italy and in Sweden on Ocean Acidification. Based on a real experience at school, the Lab is available on the University of Trieste website <http://dsvs1.units.it/eco2/>. The Lab is access free.

## The Facebook strategy as an interactive communication tool in the RITMARE Flagship Project

Caroppo, C.<sup>1</sup>, Boero, F.<sup>2</sup>, Giostra, U.<sup>3</sup>, Giuliano, L.<sup>4</sup>, Papa, E.<sup>5</sup> and Pugnetti, A.<sup>6</sup>

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<sup>2</sup>University of Salento - Department of Science and Biological and Environmental Technologies

<sup>3</sup>University of Urbino, Environmental Science Faculty

<sup>4</sup>Commission Internationale pour l'Exploration Scientifique de la Mer Méditerranée (CIESM)

<sup>5</sup>Consorzio Nazionale Interuniversitario per le Scienze del Mare (CONISMA)

<sup>6</sup>National Research Council, Institute of Marine Sciences (CNR-ISMAR)

The Italian Flagship Project RITMARE (<http://www.ritmare.it>), funded by the Italian Ministry of University and Research, is the leading Italian marine research project for the period 2012-2016. One of its aims is promoting the establishment of a permanent forum between researchers, decision makers and stakeholders, so to foster the integration and transfer of research results to a large public. Social media and particularly Facebook (FB) can significantly contribute to such objective. Since its activation (December 2012) the RITMARE FB page (<https://www.facebook.com/ProgettoRitmare>) is allowing to communicate with large groups of people very quickly and efficiently. FB represents actually not only a "window" to deepen and further disseminate information about the Project but also to educate people to the knowledge, protection and conservation of the marine environment. Until today almost 1,000 people visited the RITMARE FB page, with a viral maximum capacity, i.e. the number of individual users who have viewed a new item on the published page from a friend (not directly from our page), of 3,166 people and an average weekly number of 676 visitors. Demographic analysis indicated that 55% of users are women whereas adults aged between 25 and 44 years make up 63% of users. People from Italy, France, United Kingdom, Spain and Germany are visiting the website, mainly through the Google engine.

The most visited posts were those dealing with the overexploitation of fish stocks, the bloom of gelatinous plankton, biodiversity and biotechnologies; however, also posts related to the activities of the different WPs of the Project, in particular those referred to particular case studies (e.g. Mar Piccolo in Taranto), attracted the attention of many users.

The main issues that we will be dealing with in the next future will be the involvement of a greater number of visitors and encouraging more interactions with the proposed contents.

### **“Teacher on Board “– Improvement in ocean science literacy through immersion in oceanographic cruises**

Costa, R., Silva, S. and EMEPC, emepc.  
Task Group for the Extension of the Continental Shelf

The Task Group for the Extension of the Continental Shelf (EMEPC) developed a program named “teacher on board” to broaden the participation of teachers in technical and scientific Portuguese cruises in the Atlantic Ocean. The scope of this program is to give teachers a clearer insight into ocean sciences, a larger understanding of ocean technology and research studies, in order to increase their science and ocean literacy.

The “teacher on board” provides a unique learning environment and is driven by active participation of teachers in daily research activities. Participation in scientific campaigns immerses teachers in the culture of ocean science. Asking questions, learning techniques, using new scientific vocabulary, analyzing data, and being with marine scientists on a daily basis are all part of the culture of science.

During more than ten days, teachers join a community of scientists and come to understand science through scientific inquiry in a hands-on experience. Moreover, during the program teachers are expected to develop inquiry activities based on their work aboard to support teaching and learning in their classrooms and labs.

A research study is being conducted by exploring science teacher beliefs and practices with regard to learning outcomes, namely on their inquiry and nature of science before and after their engagement. Preliminary results found that teachers think differently about how science is conducted and how ocean science may be conducted in the science classroom after their participation. Furthermore, results from the observed practices show that the link between teacher beliefs and teacher practices is not always straightforward.

## **The Shore Thing Project - Climate change monitoring by students and community groups**

Crouch, FC., Gibb, NG. and Mainwaring, KM.  
Marine Biological Association

The temperature of our seas is rising. Scientists predict that the average seawater temperature could rise 2oc by the 2050s. The Shore Thing project gives 16+ students and community groups the opportunity to take part in 'REAL' science to help monitor the impact of warming seas on our rocky shore species. The project follows on from the UK's Marine Biodiversity and Climate Change Programme (MarClim) run by the Marine Biological Association. MarClim provided strong evidence that recent climate change has resulted in changes in the abundance, population structure and biogeographic ranges of a number of intertidal indicator species. The Shore Thing aims to continue contributing to this long-term monitoring whilst engaging schools and volunteer groups through fieldwork in marine conservation. The survey itself consists of transect species recordings at upper, middle and lower stations of the rocky shore and a final 20 minute effort based search for climate change indicators and non-native species. The information collected by volunteers and pupils is then sent to the National Biodiversity Network where it is disseminated to the wider community and significantly contributes to our knowledge of marine biodiversity and the impacts of climate change. The overall process of the Shore Thing encourages individuals and groups to gather and handle data, learn valuable survey techniques and practice species identification, all of which have the potential to strengthen the link between education and marine research in the UK. Shore Thing is now in its 7th year, it continues to grow along with the database which now has over 40,000 species records from over 300 surveys completed at 145 sites around the UK. This year we will expand on the 50 schools already involved in the project, encourage volunteers to re-survey sites, provide training in Scotland, Wales and England and develop new educational resources for schools and community groups.

## **European Marine Science Educators Association (EMSEA)**

Crouch, F<sup>1.</sup>, Copejans, E<sup>2</sup> and Fauville, G.<sup>3</sup>  
<sup>1</sup>Marine Biological Association, <sup>2</sup>Flanders Marine Institute (VLIZ) and <sup>3</sup>University of Gothenberg

If teachers have little to no knowledge of ocean science principles and no awareness of the challenges the ocean and coasts are facing, can we expect them to teach students effectively? Teachers and environmental educators are thus important agents for the ocean. But an effective educational transformation depends on how motivated, capable and supported our science teachers and educators in coastal centres or aquaria area. So it is critical to pay close attention to how we engage each one of them to develop a long lasting and caring attitude towards the marine and coastal environments. How can we do this across Europe?

The National Marine Educators Association (NMEA) in the United States has developed a programme of Ocean Literacy based on 7 fundamental principles:

- The Earth has one big ocean with many features
- The ocean and life in the ocean shape the features of the Earth
- The ocean is a major influence on weather and climate
- The ocean makes the Earth habitable
- The ocean supports a great diversity of life and ecosystems
- The ocean and humans are inextricably interconnected
- The ocean is largely unexplored.

Inspired by the work of NMEA the European Marine Science Educators Association ([www.emsea.eu](http://www.emsea.eu)) was established in 2011 as a result of discussions at an International workshop organized by NMEA as part of their annual conference in Boston. The aim of EMSEA is to 'facilitate the exchange of best practice in marine education, to provide a networking directory for marine educators and to organize annual conferences for educators in Europe'.

This is just the beginning; with your support we can develop EMSEA into a robust European network of enthusiastic and passionate educators,

scientists and policy makers with one overarching goal – An ocean literate society.

### **Development of outreach and marine education at Marine laboratory Aberdeen, over the last twenty years.**

Dunn, J  
Marine Scotland Science

The Marine Laboratory in Aberdeen has always been involved in Marine science education, but has developed a wider range of outreach activities to educational establishments, from primary schools to universities and everything in between, over the last twenty years.

The development began with involvement in Tech Fest, a month long science festival in Aberdeen. A presentation - "What does a Marine Scientist Do?" was delivered four times a day to school groups for seven days.

Following on from this, several different versions of this presentation were prepared for all ages of children. Over time, an interactive road show of the presentation was developed, which involves quizzes, a dressing up box and hands on experiments.

Alongside this, the Laboratory was registered as a certified supplier for work experience for secondary school pupils from Aberdeen and Aberdeenshire. I became the a Science Technology Engineering and Mathematics (STEM) ambassador in 1993, at a time when the number of work placements increased dramatically and also started attending careers evenings at various schools throughout the Grampian area.

During the summer of 2005, the Laboratory began hosting Nuffield students for six week placements. The students were recommended by their schools and would usually be just about to go to University. They were required to produce a scientific report and poster, which was an extremely steep learning curve for most.

Links were built with Glasgow School of Art in 2007, when a graduate engineer approached me asking to work on a prototype that I had been struggling with. Since then, three more graduate engineers have completed projects with us.

More generally, we have prepared a series of booklets for schools, and have taken part in an interactive TV production with 42 schools.

## Ocean acidification in the classroom

Fauville, G.<sup>1</sup>, Miller, P.<sup>2</sup>, Hodin, J.<sup>2</sup>, Thorndyke, M.<sup>1</sup>, Dupont, S.<sup>1</sup> and Epel, D.<sup>2</sup>

<sup>1</sup>University of Gothenburg

<sup>2</sup>Hopkins Marine Station of Stanford University

Carbon dioxide is dramatically rising as a result of human activity; one result is global warming, and an equally important consequence is ocean acidification. In the last 20 years, ocean acidity has increased by 30%, and is rising steadily. If citizens are to address such critical environmental issues, they must first become aware of and understand them.

The Inquiry-to-Insight (I2I) project promotes international collaboration among high school students as they study the causes and effects of climate change and ocean acidification, and work together to envision solutions to carbon dioxide related environmental issues. Our team at I2I has developed freely-accessible, interactive digital learning tools to study climate change and ocean acidification. We will share two activities that focus on ocean acidification.

The virtual lab Our Acidifying Ocean (<http://i2i.stanford.edu/AcidOcean.htm>) presents evidence for the rise in atmospheric carbon dioxide levels and corresponding drop in pH of the ocean. It then highlights the principles of chemistry pertinent to ocean acidification in an interactive tutorial. Students also investigate possible scenarios for the future as they relate to our production of carbon dioxide. Students then conduct an experiment at our virtual lab bench with larval cultures reared in today's ocean pH level of 8.1 and the predicted future ocean pH level of 7.7. They then analyze real data, measuring a subset the larvae that they raised in the experiment. Different classmates measure different larvae, and compare their results to a larger sample, learning about the importance of replication and sample size.

The broader environmental and social implications of ocean acidification are explained in the interactive VoiceThread presentation of acidification expert Dr. Sam Dupont. This presentation gives students the opportunity to follow a real scientific talk at their own pace, browse the presentation, and leave questions for scientists to answer.

## Changing School Curriculums - an opportunity for Marine Education in Ireland

Fleming, MF., McCauley, VMcC., Lenaghan, JL. and Grehan, AG.

National University of Ireland - Galway

The extent and focus on Marine Education in the Irish second-level curricula is very limited and a significant feature is that it is more an optional extra rather than a core element. To many outsiders this is an inconceivable situation, considering the historical influence of the sea and its impact on the cultural, economic and social life of the nation. This poster asks whether the opportunity to promote and lead change has arrived? Schools in Ireland are currently planning for the introduction of a 'new' Junior Certificate curriculum in 2014 with an emphasis on curricular relevance and pupil context. Fewer core subjects together with short school-based courses, designed with local needs and context in mind is a feature. This poster provides a short review of the current level of marine education within the geography and science curriculum and explores the opportunities presented by the growing awareness of the importance of localized curriculum design and planning. What are the 'real' opportunities presented by this changing scenario? What type of teaching and learning experiences are needed? Within this space of change is there a real opportunity for meaningful collaborations between teachers, marine educators in higher education and research institutes? We propose that a 'hybrid' space of second-level curricular activity can be created to further marine education with the potential to inform future similar collaborations at European level.



### **Using Skype as a teaching tool to bring International Marine Science into the classroom.**

Gebbels, SG.  
Newcastle University

Susan Gebbels worked for 8 weeks as the International Ocean Drilling Programmes Education and Outreach Officer on board the Research Vessel: JOIDES Resolution. The expedition's aim was to drill 5000m down into the lower oceanic crust to recover geological samples from the Hess Deep rift in the mid Pacific Ocean. Susan's role was to use Skype to deliver ship to shore science broadcasts and ships tours to schools all over the world. At the end of the expedition she had worked with 4000 young people in 16 countries in 98 schools. An IODP record. The poster will outline her work and the potential of Skype as a teaching tool to bring international, world class marine science into the classroom.

### **A pilot study of a regional curriculum focusing on ocean literacy**

Gebbels, SG. and Russell, AR.  
Newcastle University

The School of Marine Science and Technology (Newcastle University) has an excellent Outreach and Engagement group based at The Dove Marine Laboratory. We were inspired after the EMSEA conference in Brugge 2012 to initiate and deliver a pilot study into a regional curriculum based around the maritime resources in the NE of England. This was particularly exciting as it tied in with pedagogical approaches being pioneered at the School of Education in the same university.

In the current era of change towards a school based curriculum, politicians and headteachers appear to agree that the nationally prescribed body of knowledge contained in the National Curriculum should provide a standard entitlement but should not define everything that is taught in schools. The aims of our input into a NE England regional curriculum are to create engaging learning experiences that draw on the locality, at the same time involving a diverse range of stakeholders in the education of young people. During the next 6 months we will be running a pilot with 3 primary schools, we hope to present the results at the EMSEA 2013 conference.

## Bridges between school and blue science

Geraldes, DA.<sup>1</sup>, Mata, B.<sup>1</sup>, Farinha, A.<sup>1</sup>, Drago, T.<sup>1</sup> and Costa, R.<sup>2</sup>

<sup>1</sup>Portuguese Sea and Atmosphere Institute

<sup>2</sup>Task Group for the Extension of the Continental Shelf

Nowadays, science apprenticeship should be focused in the development of skills that go beyond the simple acquisition of concepts and knowledge. Based on this assumption, the Portuguese Sea and Atmosphere Institute, I.P. and the Task Group for the Extension of the Continental Shelf created a pilot project called "Bridges between school and blue science".

The key objectives of this project are to promote scientific and ocean literacy among the youth community and to raise youngsters' awareness for the meaning of the ocean.

We propose the implementation of inquiry based activities where students work in real scientific research contexts, always with a strong connection with the sea. In this process students will be guided by a mentor and it will be developed in three steps:

I - Implementation of teaching strategies of inquiry nature, where students will learn how to prepare and develop a scientific project;

II - Integration of the students in a real scientific context, where they will play a proactive role in the prosecution of an existent scientific project;

III - Comprise the conclusion of the research work that should end with the production of a scientific paper or poster elaboration. All our proposals are in agreement with national curriculum guidelines.

Students' participation in "Bridges between school and blue science" brings them closer to the real scientific world and we expect them to acquire an understanding of marine sciences that can strengthen, extend and complement the knowledge gained through the school curriculum. It also allows them to add a more conscious decision related to a higher education in scientific areas, particularly on ocean sciences.

## Strategic Cooperation in Marine Education

Gerdes, AG. and Pätzold, MP.  
MARUM, University of Bremen/Germany

During the recent years the MARUM school lab has become a nodal point of a national (and partly international) network on marine education. In order to further improve ocean literacy and marine education on a national level new strategic agreements have been concluded. Since early 2013 the school lab has been cooperating with National Geographic Germany's children magazine "National Geographic Kids".

The poster "Strategic Cooperation in Marine Education" presents basic aspects of this cooperation. It depicts the role of audiovisual material such as the "experiments of the month" (see below) in the context of ocean literacy and presents examples how and to which end NG Kids and the MARUM school lab cooperate online and in print. Finally future perspectives of the cooperation are highlighted and lessons learnt elucidated.

Background:

MARUM, the Center for Marine Environmental Sciences in Bremen/Northern Germany founded its school lab already in 2001. The aim of the MARUM UniSchoollab is to introduce geosciences in schools from level 1 to 12. During the last decade more than 30 000 school children attended courses dealing with global cycles like water and rocks and learned about the development of earth climate during the past, the present and the future. In order to enhance the visibility of school lab activities the website was relaunched recently. Moreover the school lab became a member of the Facebook community. In the column "Experiment of the month" a series of video are available which covers subjects like "the air rocket" or "the swimming egg".

## Citizen Science in Shark Conservation

Gordon, CG. and Richardson, JR.  
The Shark Trust

Citizen science – the involvement of volunteers in science - can be a useful tool in terms of engaging members of the public, raising awareness and aiding scientific data and information collection. To create effective protected areas and to better manage fisheries we need to know as much as possible about shark populations and movements. The Trust has a number of citizen science projects which contribute to this, including:

- The Great Eggcase Hunt was initially conceived as a way to raise public awareness of the presence and diversity of sharks, skates and rays in British waters, whilst also securing knowledge on the distribution of these species. Ten years on and the Great Eggcase Hunt now represents one of the UK's most popular marine volunteer recording programmes with over 34,000 records submitted to the database.
- Anglers are uniquely placed to record distribution information; the Angler Recording Project in the Southwest of England asks for shark, skate and ray catches to be recorded. Information collected for this project increases our understanding of inshore populations in the Southwest and in time will feed into more effective fisheries management and marine protected areas.
- The Basking Shark Project is a great way for shark enthusiasts of all ages to get involved with Basking Shark conservation through either the Sightings Database or the Photo-ID Database, which store valuable information about this charismatic species, helping to map individual's movements.

Whilst providing easily accessible information, it must be recognised that citizen science does not provide a fully comprehensive dataset, as it relies on occasional finds/submissions rather than being survey-based. However once verified, information can become data and by harnessing modern technology and public enthusiasm for science, can increase the datasets available to the Trust for use in tangible conservation benefits.

## iBook Resources for Marine Education – Investigating Irish Coral Reefs

Grehan, AG., McCauley, VMcC., Lenaghan, JL. and Fleming, MF.  
National University of Ireland - Galway

Linking science to everyday life has been frequently suggested as a way of making science more relevant to students (Campbell and Lubben, 2000). Marine science by its very nature is explicitly linked and entwined in the lives of our students and therefore, is argued to be an important pedagogical tool for motivating students (Andrée, 2005). In this digital era of ubiquitous technology, the Apple iPad platform is rapidly coming to the fore in educational resource design as an innovative portal for the creation and display of motivating and engaging educational resources. NUI Galway has pioneered the use of iBooks for use with iPads to provide science educators with a collection of videos (Science Hook Series) that capture novel and engaging aspects of science topics. Here we present an overview of an iBook produced to introduce the topic of Irish cold-water coral reefs to secondary level students. Irish coral reefs have been one of the major discoveries in Irish marine science over the past decade. We now know that Ireland is home to spectacular deep-water coral reefs that rival their tropical reef cousins in terms of being hotspots of biodiversity. Despite extensive media coverage of some of the oceanographic campaigns involved in these discoveries, public knowledge about these spectacular coral reefs is still low and information about them has not made its way onto the secondary level curriculum.

Campbell, B. & Lubben, F. 2000. Learning science through contexts: helping pupils make sense of everyday situations. *International Journal of Science Education*, 22, 239-252.

Andrée, M. 2005. Ways of using 'everyday-life' in the science classroom. In: Boersma, K., Goedhart, M. De Jong, O., & Eijkelhof Red, H. (eds.) *Research and the Quality of Science Education*. Dordrecht: Springer.

## **MARLISCO: Engaging society to reduce marine litter**

Hartley, BL, Thompson, RC. and Pahl, S.  
Plymouth University

Marine litter presents a growing threat to wildlife, coastal industry and human health. Insufficient knowledge, efficacy and motivation present barriers to acceptance and behavioural change regarding this important environmental issue. The 'MARLISCO' project (Marine Litter in European Seas: Social Awareness and Co-Responsibility) works across 15 European coastal countries to raise societal awareness of the problem and potential solutions to marine litter. Engagement activities, including a national video contest for school children, debates involving key sectors, public exhibitions, and a number of educational and outreach activities will take place and changes in attitudes and behaviours will be assessed.

Study 1 (n=150) examines 9-12 year old children's perceptions about marine litter in a short survey before and after participating in an educational engagement activity at the National Marine Aquarium. Children learnt about the causes and consequences of marine litter and actions they could take to help. We expect children's knowledge, concern, and actions which reduce marine litter to increase following the activity. Study 2 (n>4000) assesses societal perceptions about marine litter and potential solutions in a large European survey across the NE Atlantic, Med, Baltic and Black Sea regions. Understanding current European attitudes and barriers toward this issue is crucial in developing societal solutions.

The MARLISCO project fills an important gap in the marine litter literature by systematically investigating societal attitudes and perceptions regarding the problem, and using these insights in working towards solutions that are accepted by a range of stakeholders.

## **ORCA citizen science: public participation in offshore whale and dolphin ferry surveys.**

Lomax, AL. and Jones, BJ.  
ORCA

Commercial passenger ferries are frequently used as platforms of opportunity to conduct whale and dolphin (cetacean) surveys in UK and European waters. ORCA has engaged with the public, providing opportunities for volunteers to take part in offshore surveys, on ferry based platforms since 2000. The annual survey effort which ORCA undertakes on these platforms, through its Marine Mammal Monitoring Programme, contributes vital baseline data to government agencies to inform decisions for conserving cetacean populations. ORCA has engaged ~500 volunteer surveyors, collecting data from 32 ferry routes on board 11 different vessels. Volunteers have carried out 286 surveys and recorded 8511 sightings of 91746 animals in European waters. The Marine Mammal Monitoring Programme is the core of ORCA's citizen science work. This study aims to outline the demographic and geographic distribution of the programmes' appeal to the public. Demography's of volunteer surveyors were analysed to determine the age and background of people participating in the programme. Initial analysis of the ORCA volunteer base shows top and tailing of ages, with a high proportion of young (18-25) and older volunteers (>50). This is likely due to those age groups having more spare time, fewer commitments and dependents. The geographical distribution of survey volunteers were compared to the location of the ferry ports associated with ORCA operated survey routes. Results observed that a significant percentage of volunteers came from regions with survey associated ferry ports, with particular concentrations in the Northeast and South Coasts of England. However, notable numbers of volunteers also came from adjacent and marginal regions not near ferry ports. This indicates that an engaging citizen science project, such as the ORCA Marine Mammal Monitoring Programme, will draw interest and participation from a wider geographic area. Therefore, such activities have the potential to engage large numbers of people in marine science on a national level.

## **The use of shark research as a medium to educate coastal communities on sustainable marine resource management**

Mc Closkey, RMC.<sup>1</sup> and Johnston, EJ.<sup>2</sup>

<sup>1</sup>Irish Basking Shark Study Group

<sup>2</sup>Queen's University, Belfast; Irish Basking Shark Study Group

How small coastal communities dependent on the sea may adapt to changes in fishing related legislation focused on a sustainable harvest ideal is poorly understood.

Here we describe a project where a scientific research body (Queens University, Belfast) a local community organisation (Inishowen Development Partnership) and a marine conservation group (Irish Basking Shark Study Group) have worked together to instil the skills, knowledge and confidence necessary for a remote coastal community centred at Malin Head, Co. Donegal to consider sustainable marine resource management strategies.

The basking shark, a high profile species long associated with Malin Head was developed as a Totem of the marine resource, and a medium to coordinate established community and scientific research projects under a single umbrella. Three projects (Depth Charge, Monster Munch and Shark Camp) incorporating both scientific research and community education were developed within and delivered to different segments of the community.

A three-pronged approach was adopted for the delivery of the marine education

1) A practical application of scientific research for educating members of the community involved in commercial fishing

2) A formal, in-school education programme targeting primary school children

3) An informal, voluntary approach within the community youth network

Measurable outcomes have included an increase in marine focused business diversification, an increase in ocean literacy and the establishment of a pro-shark conservation outlook within the target communities.

## **About diving, science and education**

<sup>1</sup>Studio Associato Gaia snc, Genova - Italy

<sup>2</sup>Centro di Educazione Ambientale Comune di Imperia, Imperia - Italy

<sup>3</sup>InfoRmare, Imperia - Italy

<sup>4</sup>DISVA - Università Politecnica delle Marche. Ancona - Italy

Albeit mostly considered a recreational activity, SCUBA diving is grounded on a lot of scientific and technological knowledge, and pays back being an essential tool for marine research. Divers move within statistically relevant safe boundaries thanks to studies about physiology, physics and engineering - just to mention a few. On the other hand, much research in several domains (such as marine biology and ecology, marine geology and even human physiology) requires field practice by diving scientists. This is not to mention the essential work by technical diving operators, for instance in setting up research infrastructures.

Diving and science go hand in hand. However we tend to underestimate the role of diving in promoting science (and ocean) literacy. When taking to the theory of diving, even children are introduced to anatomy and to fundamental laws in physics - easily learning what may sound otherwise complex in a classroom context. While diving, people from the most diverse layers of society have a unique experience of nature that often leads to increased curiosity, understanding and awareness. More important, with a few million recreational divers worldwide of different age, gender and socio-economic background, diving relies on an impressive network of multipliers that can effectively pass the acquired knowledge to their non-diving entourages.

This shall not be a one-way relationship. As marine scientists, we can learn a lot from divers, too. By visiting a variety of remote places and/or repeatedly exploring less remote ones, divers are an invaluable source of information, as acknowledged by an increasing number of science-driven initiatives based on volunteers.

New programmes built on the interaction between science and diving will strongly improve our understanding of seas, while promoting science education, ocean literacy and environmental awareness both to school students and adults.

## **The Ocean Explorer Centre – SAMS' new visitor and outreach centre in Oban, Scotland**

Miller A  
SAMS

The new Ocean Explorer Centre uses a range of interactive methods to showcase the rationale and main outcomes of SAMS' research to tourists, visiting schools and the local community on Scotland's scenic west coast. It encourages visitors to turn into explorers for the time of their visit – and hopefully beyond.

Taking an 'edutainment' approach the Centre incorporates an underwater observatory with three cameras that the audience can operate, and associated hydrophones to create an underwater soundscape.

A giant touchscreen allows people to explore the lay of the Firth of Lorn seabed recently surveyed to highest possible resolution by a major SEUPB-funded project.

Algal biofuels feature in a dedicated display with an inverted microscope to explore micro-algae and a set of six RFID-tag driven videos that introduce visitors to biofuels and algae, biofuels from microalgae and seaweeds, sourcing of seaweeds for bioenergy purposes and discusses how likely it is that our cars will drive on sunshine caught by algae.

An Arctic change zone incorporates audio-stories from six polar oceanographers and is a particular attraction for younger visitors thanks to a tunnel. Here 'tunnel crawlers' can find out what kind of animals live on, in or under sea ice by use of UV torches. The tunnel is made more exciting still with the sounds of breaking ice and creaking glaciers.

Models of an underwater glider, a coastal drifter and an old Argo float tell the story of ocean currents.

Short films about the marine environment and marine research – partly produced by SAMS' own filmmaker-in-residence – are shown in a polar-themed small cinema.

Visitors are encouraged to embrace modern communication technology – that is so very important to many oceanographers. Additional information about the sea and marine science can be accessed by scanning some of the exhibition images with smartphones or tablets that have downloaded the Layar App. This technology allows SAMS to add constantly new digital information to the Ocean Explorer Centre without additional costs for new displays.

The Ocean Explorer Centre only opened in August and plans are afoot to add a marine technology garden in the future.

## International Student Carbon Footprint Challenge

Miller, P.<sup>1</sup>, Fauville, G.<sup>2</sup>, Hodin, J.<sup>1</sup>, Thorndyke, M.<sup>2</sup>, Dupont, S.<sup>2</sup> and Epel, D.<sup>1</sup>

<sup>1</sup>Hopkins Marine Station of Stanford University

<sup>2</sup>University of Gothenburg

In the International Student Carbon Footprint Challenge (ISCFC), students explore precisely how their different behaviours affect their carbon emissions through use of a digital tool that we designed specifically for high school students. This centrepiece of the ISCFC, our carbon footprint calculator

(<http://footprint.stanford.edu/calculate.html>), is unique in its comprehensive, student-focused, inquiry-based approach, tailored to provide location-specific data for every country in the world. The calculator is scientifically validated with clear documentation, provides instantaneous feedback on the connection between specific behaviours and emissions, and allows students to save their data for future use.

Students calculate the carbon impacts of their personal choices relating to transportation, home energy, diet and purchases. Following their calculations, classes submit their data and receive a pin on our world map, which shows their mean footprints and standard deviations. Then, students log on to a social learning network developed by our partners at Einztein (<http://www.einztein.com>), where they engage in asynchronous international dialog in microblog format, grappling with difficult issues arising from their footprints such as prioritizing "wants" and "needs," the pros and cons of nuclear energy, and ways of promoting sustainable development across the globe. The depth and passion of the student dialog has been inspiring. We invite all EMSEA participants to involve their classes in our quarterly ISCFC sessions.

## Learning at the National Marine Aquarium

Murray, NM.

National Marine Aquarium

Learning at the National Marine Aquarium

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.

So how does the Aquarium practically endeavour to fulfil this mission? The answer is to Just Add H2O! The National Marine Aquarium is home to the Just Add H2O Learning Programme. Just Add H2O has a simple aim: to give as many people as possible the opportunity to discover and learn through the inspiring marine environment. The guiding principles of Just Add H2O are: Learning from Fun, Learning from Experience, Learning from People and Learning from Science.

There are two distinct arms to the Just Add H2O Learning Programme – Public interaction delivered by our Public Engagement Team, otherwise known as Aquarium 'Hosts' and for schools/nurseries and higher/further education establishments we have our 'Learning Team'. These two teams are not mutually exclusive. They support each other and work together to deliver the 'Marine Curriculum'. Practical delivery is based around talks and shows, tours, workshops, immersion days, art and science busking, outreach - to schools and community events, snorkelling, beach cleans and many more delivery approaches.

The scope of learning arising from these activities is broad and not all can be planned or evaluated. However, in striving to prove that interactions between the National Marine Aquarium and our patrons are contributing towards our drive for marine conservation, the work of the two teams is evaluated using everything from simple customer feedback forms or visitor satisfaction scores, to the formal 'Inspiring Learning for All' evaluation framework used for all educational visits.

The future of Just Add H2O looks bright with new projects in the pipeline such as a membership programme, installation of video conferencing facilities and working with other establishments to deliver the Just Add H2O Learning Programme in other settings. The reach of Just Add H2O and the important conservation messages it hopes to deliver are ever expanding.

## **The Shark Trust Angler Recording Project**

Richardson, JR. and Gordon, CG.  
The Shark Trust

Distribution and abundance data are fundamental in establishing sustainable elasmobranch fisheries in the Northeast Atlantic. As well as scientific sources, useful data can also come from 'citizen science' projects. With this in mind, the Shark Trust initiated the Angler Recording Project in 2010, encouraging sea-anglers in the Southwest of England to record and share details of their shark, skate and ray catches. The potential of anglers in the Southwest as a source of data is significant, with more than 240,000 residents of the region identifying themselves as sea anglers, while visitors spend an estimated 750,000 days sea-angling in the region each year.

As well as capturing species-specific distribution and abundance data, the project is supported by a range of hard-copy and online resources designed for use by sea-anglers. These resources provide information on wider issues facing shark populations, species-specific identification, elasmobranch biology and ecology and 'best practice' tips for the handling of elasmobranchs, as well as outlining fishing gear and methods which reduce the impact of capture on fish.

## **The Intergovernmental Oceanographic Commission of UNESCO: ocean literacy in action**

Santoro, FS., Watson-Wright, WWW., Pissiersen, PP., Grimes, SG., Valdès, JLV., Fischer, AF. and Aarup, TA.  
IOC-UNESCO

UNESCO's Intergovernmental Oceanographic Commission (IOC) promotes international cooperation and coordinates programmes in marine research, services, observation systems, hazard mitigation, and capacity development in order to understand and effectively manage the resources of the ocean and coastal areas. By applying this knowledge, the Commission aims to improve the governance, management, institutional capacity, and decision-making processes of its Member States with respect to marine resources and climate variability and to foster sustainable development of the marine environment, in particular in developing countries. A number of educational activities linked to the major IOC-UNESCO programmes (e.g. GOOS, Tsunami Early Warning System, Argo Programme) are presented in this poster. Future initiatives and perspectives are presented as well.



## One World One Ocean – A Cross Curriculum Approach

Savage, SP.  
Shoreham Beach LNR

One World One Ocean is a project that links UK Schools with ocean scientists and other experts from around the world, and creates real time events that are shared with schools. The project also provides opportunities for these experts to share their knowledge and experiences with a new audience.

The core of the project is a character called 'Ed the Bear' a real teddy bear sent to experts around the world to help create the factual on-going story. His global adventures are recorded on a weblog (online journal) and provide the basis for school visits, activities and public events. I chose a bear as the character because all UK schools have either a school (or class bear) that is already used as an education tool in literacy and geography. The point of reference for the children is the photographs of the character in each location, including a real diving bell, the bear itself and objects collected from various locations.

This cross curriculum approach allows children to explore the topics more widely, makes the message more personal and powerful and increases the ocean topics that can be covered in the classroom.

Ed the Bear has been travelling since 2009, returning to the UK periodically to share his experiences with schools etc. The project reflects many elements of the ocean literacy framework, encourages a sense of local as part of the global and helps support sustainability work being done in UK schools as the ocean dimension is often missing.

Organisations and scientists that have helped create the on-going project include NOAA National Marine Sanctuaries (12), Mote Laboratory, Apex Predators, South African Heritage Resource Agency, National Black Scuba Divers, The Marathon Turtle Rehabilitation Hospital, Two Oceans Aquarium, Florida Keys Dolphin Research Centre. We hope to expand this to Europe and other global locations.

## Discovery of Sound in the Sea: Resources for Educators, Students, the Public, and Policymakers

Scowcroft, GS.<sup>1</sup>, Vigness-Raposa, KVR.<sup>2</sup>, Knowlton, CK.<sup>1</sup> and Morin, HM.<sup>1</sup>

<sup>1</sup>University of Rhode Island, Graduate School of Oceanography

<sup>2</sup>Marine Acoustics, Inc.

The scientific community and the public have become increasingly aware of, and concerned about, underwater sound. There is increasing interest in learning about sources and uses of sound, and the potential effects of underwater sound on marine life. To encourage this interest, there is a need to provide scientific information at a level appropriate for the general public, educators, the media, and policymakers. The Discovery of Sound in the Sea website (DOSITS, [www.dosits.org](http://www.dosits.org)) is one of the most comprehensive Internet resources on underwater sound. The website includes over 400 webpages of scientific content drawn exclusively from peer reviewed publications on the physical science of underwater sound, extensive education resources, as well as informative galleries, including an interactive Audio Gallery with over 70 examples of underwater sounds. Resources available on DOSITS include a Facts & Myths quiz, Frequently Asked Questions, structured tutorials, educational activities, and PDF reprints. A tri-fold pamphlet and a 15-page educational brochure are available in several languages, including Spanish, Italian, and French. DOSITS also provides efficient access to timely information on the effects of underwater sound on marine animals.

The DOSITS project, conducted by the University of Rhode Island Graduate School of Oceanography in partnership with Marine Acoustic, Inc., was launched in November 2002. Since then, the DOSITS website has received nearly 55 million hits. Support has been provided by the U.S. Office of Naval Research, National Science Foundation, and National Oceanic and Atmospheric Administration.

## Life around the turbines

Smith, CJ., Sewell, J. and Guy, GJ.  
Marine Biological Association

'Life around the turbines' is an educational outreach project funded by COWRIE (Collaborative Offshore Wind Research Into the Environment) and run by the Marine Biological Association (MBA) of the UK. COWRIE was set up to look into the effects of offshore wind farms on the environment and to disseminate this information to the wider public as part of an outreach programme. The project was designed to promote the work of COWRIE to school children around the UK. Phases I and II of the project ran between 2008 and 2010, where the MBA worked with the National Marine Aquarium in Plymouth developing school workshops and web based resources focussed on three educational themes: habitats, adaptations and food webs; wind turbine technology; and wind turbines and the environment. In 2011, the MBA received additional funding from COWRIE to extend and develop 'Life around the turbines' into phase III. The funding has allowed a greater number of activities to be undertaken between 2011 and 2013 including: the development of new school workshops; online resources and website development; marine educator training camps; training bursaries for people seeking to gain experience in marine education; and the production of an educator's 'My Sea Book' due to be launched late 2013. The MBA has invited marine life educators and organizations to contribute to the publication in order to provide them with an opportunity to promote their organization and the work they do to a national/international audience. The MBA hopes that by inviting a wide authorship it will ensure the book contains a range of different, new and exciting activities and resources. The book will be useful to teachers, parents and educators with activities for all ages.

## Knowing the Ocean - a navigation chart for ocean literacy in Portugal

Suarez, MS.  
Ciencia Viva

From the 90s onwards, significant steps were taken both in Portugal and in the European Union (EU) towards a real marine policy. Due to the relevance of the sea for Portugal, with the third largest exclusive economic zone in Europe, a National Strategy has recently been established. Disseminating knowledge about the ocean is therefore a key area for Ciência Viva, as the Portuguese agency for scientific culture.

The project 'Conhecer o Oceano' (Knowing the Ocean), is part of this strategy. This initiative is based on the North-American project Ocean Literacy that resulted from a wide consultation with scientific and educational institutions.

Ciência Viva coordinated the adaptation of this initiative to the Portuguese reality, in collaboration with research institutes of Marine and Education Sciences. A "navigation chart", pinpointing ocean topics in the national curriculum, is an example of a support material to help educators through ocean literacy and the corresponding resources.

## **The Atlantic and US (You and Me), Linking Ocean Science with Marine Education to Advance Transatlantic Ocean Literacy**

Tuddenham, PT.<sup>1</sup> and Olivier, BO.<sup>2</sup>

<sup>1</sup>College of Exploration

<sup>2</sup>University of Bolton

The Atlantic and US.

The Atlantic Ocean impact on us and our impact on the Atlantic Ocean.

Linking ocean science with marine education to advance Transatlantic Ocean Literacy.

The Institute of Educational Cybernetics at the University of Bolton and the College of Exploration are looking to build a partnership to support the transatlantic ocean literacy goal outlined in the Galway Statement on Atlantic Ocean Cooperation signed by the European Union, Canada and the United States on 24 May 2013 and to bid on the European Union Framework Programme for Research and Innovation Horizon 2020.

The goal is to use a specific transatlantic issue, namely the Atlantic Meridional Overturning Circulation (AMOC) to develop a system of understanding, learning and action that has isomorphic potential for other marine science and education issues. AMOC as an issue and a result of changes in the climate have immediate and fundamental effects on the populations bordering the Atlantic.

There is need for an integrated model of engagement and learning that links systemically and logically the visuals, models, data, feedback systems, personal-local-national and region relevance and meanings, with opportunities for conversation, debate and actions that can be taken at different levels. The use and implication of rapidly changing technologies such You Tube, Twitter, social media and smartphones will be used. Specific challenges in understanding cultural and language perspectives will be a key design consideration.

Relevant previous work developing systems of learning and sharing of actions and resources will be incorporated and built upon appropriate.

This is an initial framework for a creative discussion with interested parties who would like to join the partnership. For more information contact Bill Olivier PhD, Professor in Educational Technology, University of Bolton  
b.olivier@bolton.ac.uk or Peter Tuddenham, Executive Director, College of Exploration,  
peter@coexploration.net

## **Teaching A Level Biology on the rocky shore – past, present and future – a field studies council perspective.**

Ward, MA.

Field Studies Council

The Field Studies Council (FSC) has been delivering marine education to students of all ages for 70 years through residential and outreach field trips. Throughout this time they have taught 1,000s of students about ecological processes and concepts and about the scientific method through tried and tested rocky shore investigations. This paper reviews some of the whole class and individual studies used by the FSC and explores how they can be tailored to the different A level awarding body specifications. Teaching about data presentation and statistical analysis is also deliverable via these investigations. In recent years the FSC has also begun to explore more innovative ways of delivering rocky shore field courses, integrating the use of ITC both in the field and in post-fieldwork follow up. There are many opportunities for better promoting rocky shore ecosystems to teachers as an excellent resource for teaching A level ecology and other synoptic biological principles. This paper celebrates the excellent A level rocky shore fieldwork that has happened in the past and explores way it can be developed in the future.