

OCEAN LITERACY

An appreciation of the oceans
biodiversity and an understanding
of the ocean's influence on you
and your influence on the ocean



OUR BLUE PLANET



On our blue planet, the dominant feature is ocean. It contains 97 percent of the Earth's water and releases vapour into the atmosphere that returns as rain, sleet, and snow, ever replenishing the planet with freshwater.

All life, including our own, is dependent on the ocean.

Understanding the ocean is vital to understanding this planet on which we live.

What is Ocean Literacy?

The Ocean Literacy Framework was devised by ocean experts to convey essential information about the ocean and its many influences.

Ocean literacy is an understanding of the ocean's influence on you and your influence on the ocean.

An ocean-literate person understands:

- the essential principles and fundamental concepts about the functioning of the ocean;
- can communicate about the ocean in a meaningful way; and
- is able to make informed and responsible decisions regarding the ocean and its resources.

The Ocean Literacy framework consists of 7 core principles

Ocean Literacy Principle 1: The Earth has one big ocean with many features.

Ocean Literacy Principle 2: The ocean and life in the ocean shape the features of Earth.

Ocean Literacy Principle 3: The ocean is a major influence on weather and climate.

Ocean Literacy Principle 4: The ocean makes the Earth habitable.

Ocean Literacy Principle 5: The ocean supports a great diversity of life and ecosystems.

Ocean Literacy Principle 6: The ocean and humans are inextricably interconnected.

Ocean Literacy Principle 7: The ocean is largely unexplored.

The Essential Ocean Literacy Principles are supported and explained by 45 Fundamental Concepts. The Essential Principles, and supporting Fundamental Concepts were developed through a community-wide consensus-building process.

The ocean literacy principles have been developed by concerned educators and scientists in USA. An important factor of sharing this knowledge was to align the concepts with the K12 National Science Education Standards (K12 is equivalent to the UK primary and secondary schools).

Ocean Literacy UK and Europe

Due to the oceans importance and its many influences on the planet, ocean literacy is of global concern. The nearest ocean to the UK is of course the Atlantic Ocean but this is also connected to the entire ocean system

Important stages for the UK. In 2013 the Galway Statement on Atlantic Ocean Cooperation was signed on 24 May by the EU, the United States and Canada. The statement sought to stimulate a much closer cooperation between the EU, the US and Canada on transatlantic marine, maritime and Arctic research. Ocean Literacy was specifically identified in the statement as a key horizontal activity



This was followed by a working group of experts who met in Ostende on 25-26 June 2013. The workshop defined 10 marine topics for an Ocean Literacy call. The topics were published as: marine biodiversity, the deep sea, sustainable food from the sea, how oceans benefit people, oceans and human health, the need for ocean conservation, ocean governance, energy from the sea, marine pollution, recreation and leisure.

In 2014 this was followed by the transatlantic Ocean Literacy workshop hosted by Plymouth University to which I was invited to as an ocean literacy expert along with 24 other marine education specialists and scientists, focusing particularly on Trans-Atlantic issues



OCEAN LITERACY PRINCIPLES OVERVIEW

The following is a condensed overview of the 7 essential principles and some of the relevant fundamental concepts associated with each principle.

Principle 1: The Earth Has One Big Ocean With Many Features

The ocean is the dominant physical feature on our planet Earth—covering approximately 70% of the planet's surface. There is one ocean with many ocean basins. Earth's highest peaks, deepest valleys and flattest vast plains are all in the ocean. The ocean is an integral part of the water cycle and is connected to all of the earth's water reservoirs via evaporation and precipitation processes.

Principle 2 The Ocean and Life in the Ocean Shape the Features of Earth

Many of the sedimentary rocks now exposed on land were formed in the ocean. Ocean life laid down the vast volume of siliceous and carbonate rocks. Tectonic activity, sea level changes, and force of waves influence the physical structure and landforms of the coast.

Principle 3: The Ocean is a Major Influence on Weather and Climate

The ocean controls weather and climate by dominating the Earth's energy, water and carbon systems. The ocean absorbs much of the solar radiation reaching Earth. The ocean loses heat by evaporation. This heat loss drives atmospheric circulation when, after it is released into the atmosphere as water vapour, it condenses and forms rain. The ocean has had, and will continue to have, a significant influence on climate change by absorbing, storing, and moving heat, carbon and water.

Principle 4: The Ocean Made Earth Habitable

Most of the oxygen in the atmosphere originally came from the activities of photosynthetic organisms in the ocean. The first life is thought to have started in the ocean. The earliest evidence of life is found in the ocean.

Principle 5: The Ocean Supports a Great Diversity of Life and Ecosystems

The ocean is three-dimensional, offering vast living space and diverse habitats from the surface through the water column to the seafloor. Most of the living space on Earth is in the ocean

Principle 6: The Ocean and Humans are Inextricably Interconnected

The ocean affects every human life. From the ocean we get foods, medicines, and mineral and energy resources. The ocean is a source of inspiration and recreation. Humans affect the ocean in a variety of ways. Everyone is responsible for caring for the ocean

Principle 7: The Ocean is Largely Unexplored

The ocean is the last and largest unexplored place on Earth—less than 5% of it has been explored.

Ocean Literacy Programme for Primary and Secondary Schools

Primary schools

The main programme for primary schools is called One World One Ocean.

The programme is based around the real life travels of Ed the Bear which started in 2009. Ed is based at the Shoreham Beach Local Nature Reserve a site of rare vegetated shingle habitat. Concerned about the global impact on his beach of issues such as climate change, Ed the Bear has travelled to many scientists around the world to find out first hand and share with schools in the UK



On his travels Ed the Bear has encountered some amazing wildlife. He has explored many shores, dived on coral reefs and ship wrecks, come face to face with great white sharks and sat on the Antarctic ice with penguins



Rare vegetated shingle



Diving on a coral reef



Great white shark



Eagle Rays Plymouth



Gentoo penguins Antarctica



Pilot whale

In 2010 Ed the Bear was hosted by the National Oceanic Atmospheric Administration <http://www.noaa.gov/> and spent 7 months touring around 12 of the 14 National Marine Sanctuaries <http://sanctuaries.noaa.gov/> that are managed by NOAA.

Human Impact

On his travels, Ed the Bear has also witnessed first hand the damage we are doing to the ocean. This includes marine life that is choked or entangled by plastic debris, chemical pollution and various problems relating to man-made climate change.



Climate change is a complex subject and Ed has witnessed how a slight change in sea temperature is contributing to sea level rise, causing coral reefs to die, affecting weather patterns and disrupting food chains including the UK. Ed has also been learning about how excess carbon dioxide is affecting the acidity of the ocean.

Visiting Scientists and institutes

A key part of the project is the links we have created with various scientists, institutes and other experts around the world who have hosted a visit from Ed the Bear. This means we receive up to date knowledge from ocean experts and in return we provide them with an opportunity to connect with a new audience.



Ed the Bears continuing travels document real life events and accounts and help to engage audiences of all ages with the ocean and conservation issues on a more personal level. Topic modules often contain visits to several locations and experts that together explain the larger theme. This is often based round elements that we can monitor and help to explain the wider concept (e.g. climate change).

Helping the oceans

Ed the Bear has also been sent to many individuals and organisations around the world who are actively engaged in protecting the oceans in one form or another. The largest being the National Oceanic Atmospheric Administration (NOAA) including the network of National Marine Sanctuaries. It was NOAA that organised the building of Ed the Bears real-life diving bell back in 2010.



Ed the Bear has also been hosted by other organisations helping to protect the oceans by restoring marine habitats, and sanctuaries working with rescued animals such as turtles and seabirds.

How can we help protect the ocean?

We can't all go out and rescue penguins and turtles or restore coral reefs or other habitats this effort is trying to deal with the end result of the issues. To really make a difference we need to tackle these issues at their source. Most of these issues are due to our modern living that is affecting the climate, water quality or polluting our seas with plastics and pollutants.

To help understand these issues, this project aims to raise awareness of the planet's natural cycles and how human activities are damaging or impacting on them.

The ocean has a daily influence on our lives. It moderates our climate, creates our weather, provides freshwater, is a means of travel, recreation and a source of food, medicines and wellbeing. A healthy ocean is an essential part of a healthy planet.

Through our modern living we are all contributing to the damage caused to the marine environment, even if we live many miles inland from the coast. It is also true that we will suffer the effects of this damage, even if we live miles from the ocean.



To understand how we are damaging the oceans we first need to understand how oceans systems work and the benefits we gain from the ocean. This is a major aim of the Ocean Literacy Framework and also .

One World One Ocean is a programme that links UK schools with scientists around the world, and creates real time events (e.g. diving on a coral reef) that are shared with schools and provides a chance for experts to connect with a new audience. The project reflects many of the ocean literacy principles and fundamental concepts from ocean habitats, to biodiversity and marine conservation.

Ed the Bear at Trans-Atlantic Ocean Literacy Conference.

As mentioned above, in September 2014 I was invited to participate in the Trans-Atlantic Ocean Literacy Conference as a expert on Ocean Literacy as I had already been delivering many elements of the Ocean Literacy Framework, linking the schools and the public with scientists and creating global links.



As well as delivering a science education poster at the main marine educators conference I was also asked to discuss the One World One Ocean Adventures of Ed the Bear project and how it worked. It was recognised in the workshop that such approaches would also make a valuable contribution to delivering the Ocean Literacy Principles.

Working in Primary Schools

The One World One Ocean project is very adaptable and can be approached as a cross curriculum programme. The most popular approach is a science/literacy topic. All sessions will include the local perspective as well as the global.

All sessions start with an overview presentation that introduces ocean literacy, discusses why Ed the Bear is travelling the oceans, encounters with wildlife, damage to the oceans, how people are helping the oceans and that we can all help the oceans even if we don't live near a coast.

Session samples.

We have general sessions that focus on the travels of Ed the Bear which either focus on the ocean and marine life and include elements about conservation issues. There is a similar session that focuses on both a local and global location that schools can learn about and compare and link to an existing topic. Other topics include coastlines, seaweed forests, shipwrecks and ocean exploration. Two of the main specific topics focus on plastic pollution and climate change.

Plastic Pollution

Using local and global examples from Ed the Bears travels, (fish, turtles, seals, seabirds etc.), the session focuses on plastic and its uses, how plastic gets into the marine environment and harm it causes. This explores the issues around animal entanglement and ingestion of plastic and also micro plastics. We also have a class activity that focuses around the plight of the Laysan Albatross in Hawaiian Islands that die from plastic pollution which also leads to a discussion on marine pollution and where it comes from. We also make the link with UK marine birds affected by plastic debris. We also discuss the pros and cons of plastic and how recycling not only prevents plastic getting into the marine environment. An activity examines information from a local beach clean.



Climate change

This session focuses on global and local climate change. As a background the session explores how the oceans creates and moderates our climate and weather how human generated carbon dioxide is causing global warming and affecting the ocean. We look at how very small changes in sea and air temperature can cause, sea level to rise, coral reefs to die, trigger a tropical storm and disrupts food webs (including UK examples) and how these issues effects marine life such as coral, penguins and our own coast. We also look at how the excess carbon dioxide is changing the water chemistry of the ocean (Ocean Acidification) threatening corals and shellfish. The session will include examples from Ed the Bears travels.

Bella's World of Water

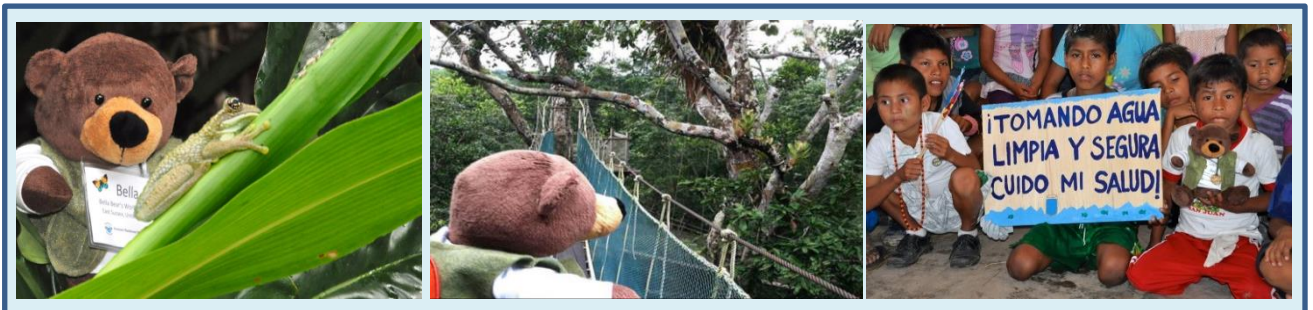
Our new character, Bella Bear, focuses on freshwater as the most valuable resource for nature and humans. From the perspective of Ocean Literacy, Bella explores the freshwater and terrestrial links to the ocean.

Bella Bear is based at the Lewes Railway Land Nature Reserve, the site was once part of the nearby railway yard hence its name. This included railway sidings and the railway workers allotments all of which have influenced the land it is today). The nature reserve is situated on the edge of the river Ouse and has many important wetland habitats.



Bella has been exploring the nature reserve at Lewes and schools can learn about the habitats and wildlife with various hands on activities. The site is a focus for local climate change with a flood model developed by the Environment Agency which explores future impact of sea level rise and climate change.

The project not only looks at how important water is to wildlife but also to humans. Activities that explore human use of water and our own personal water footprint can be followed up in the classroom and schools are encouraged to consider how to reduce water use (and at home) and to build a pond in the school grounds.



Bella Bear also looks at water globally and also water poverty. Bella also travels globally and in 2014 she travelled to the Amazon Rainforest in Peru. She explored this amazing habitat with rainforest Workshops and visited an organisation bringing clean drinking water to remote Amazon communities. Climate change has also contributed to two severe droughts in the Amazon in 2005 and 2010.

We have started to create topic modules that involve elements of both Ed's ocean and Bella's freshwater adventures

Working with Secondary Schools

The Ocean Literacy Principles also reflect elements of the secondary schools curriculum. We have been working with secondary schools on coastal geography topics that reflect elements of ocean literacy, including coastal geography, natural processes that shape our coastal and future impact of global issues such as climate change. This has included classroom sessions and practical sessions on the coast at the Shoreham Beach Local Nature Reserve where I also run the education programme.

The nature reserve programme has two main elements, physical geography and environmental studies the latter exploring the issues of balancing the protection of the rare vegetated shingle habitat with human activities of beach users and possible impact of global issues. Students are also able to study the vegetated shingle habitat and its wildlife. For more information contact us and ask for the Coastal Geography Teachers information.



Ocean Science and Technology

While the oceans create our climate and weather, provide freshwater, food, minerals, new medicines, well being and much more – so far we have only explored 5% of the ocean.

Ocean technology is becoming even more important and we are now able to probe the depths and monitor, record and study areas of the ocean that were once inaccessible. It is likely that some of the metals needed for making our modern technologies will be harvested from the deep ocean floor.

Ocean literacy principle 7 states that understanding the ocean is more than a matter of curiosity. Exploration, and discovery are required to better understand ocean systems and processes. Our very survival may hinges upon it.

We are currently working on a Stem Science Programme based around ROV kits that form part of a popular Stem Science programme in the USA and can be used to support some of the ocean literacy principles.

Ocean Exploration: Stem Science

ROV or remote operated vehicle is an important tool in ocean exploration. Many of the topics listed above for primary schools are just as relevant to secondary schools and above.

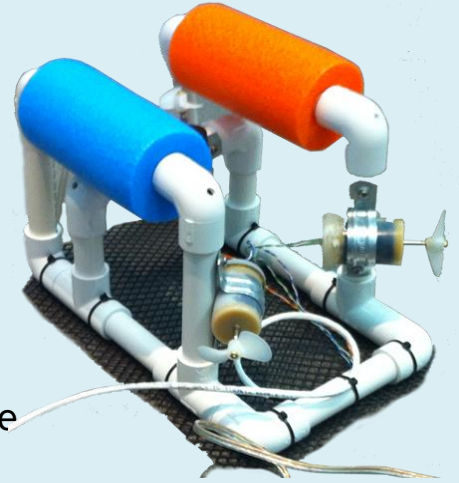
In this project we have changed the main supporting tool from a bear (Ed the Bear) to the ROV kits produced by a programme called SeaPerch

What is SeaPerch?

SeaPerch is an innovative underwater robotics program that teaches teachers and students to build an underwater Remotely Operated Vehicle (ROV) in both classroom or out-of-school setting.

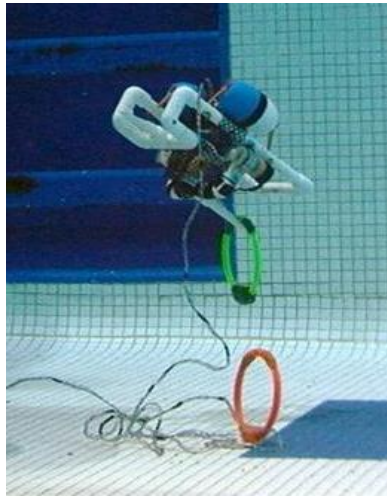
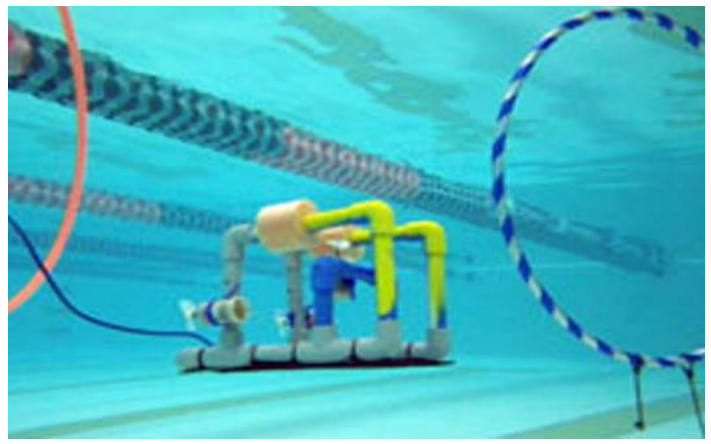
Students build the ROV from a kit comprised of low-cost, easily accessible parts, following a curriculum that teaches science, technology, engineering and mathematics (STEM) with a marine engineering theme.

Throughout the project, students will learn engineering concepts, problem solving, teamwork design skills and are exposed to all the exciting careers that are possible in naval architecture and marine/ocean engineering.



As we know students learn best by doing; and during the process of building SeaPerch, they follow steps to completely assemble the Remotely Operated Vehicle (ROV).

After the SeaPerch robot is constructed, students are encouraged to test their vehicles, deploy them on missions, and compete in a culminating event, to take what they have learned to the next level.



Students operate their ROV's to perform tasks such as manoeuvring through a maze, picking up objects or adding a webcam or water monitoring equipment

Schools outside the USA are not able to apply for a grant however the cost of the kits low and affordable.

ROV Kits can be purchased on-line from SeaPerch. As a guide, currently SeaPerch kits are **\$169 each**. The SeaPerch Tool Bag is **\$235** containing everything you will need to make the kit including 1 Power Drill, 1 Soldering Iron, 1 PVC Cutter, 1 Adjustable Vice and much more. One tool bag can be shared to support the making of several kits.

Due to other import charges that may be incurred we recommend that schools purchase kits direct from SeaPerch as schools may be exempt from this. Information about the kits can be found at <http://www.seaperch.org/index> In the USA schools compete in local and inter-state challenges.

We are keen to hear from schools who would like to know more about this project and linking Ocean Literacy with the use of SeaPerch Kits.

For more information and linked sites relating to our Ocean Literacy projects please see below.

For all general enquires about our Ocean Literacy or the ROV Programme please contact Steve Savage at

stevep.savage@ntlworld.com

For more information about the Adventures of Ed the Bear, contact Steve savage or check out the following links

Adventures of Ed the Bear weblog

<http://adventuresofedthebear.blogspot.co.uk/>

One World One Ocean website

<http://seawatch17.wix.com/one-world-one-ocean>

Bella Bears World of Water website

<http://seawatch17.wix.com/bella-world-of-water>

Coastal Geography, Shoreham Beach Local Nature Reserve

<http://www.fosbeach.com/education-on-shoreham-beach/>