YUNGA LEARNING AND ACTION SERIES

SUPPORTED BY Sida

The Ocean Challenge Badge

CBD :: FAO :: IOC-UNESCO :: PML :: WAGGGS :: WOSM

This booklet is intended as a guide for teachers and youth leaders. These individuals are responsible for the development of programmes and activities which are suitable for their group and should provide the required supervision to ensure all participants are safe and sound.

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YOUTH AND UNITED NATIONS GLOBAL ALLIANCE (YUNGA)

The Ocean Challenge Badge

Developed in collaboration with

Convention on Biological Diversity

United Nations Educational, Scientific and Cultural Organization

Intergovernmental Oceanographic Commission

PML Plymouth Marine Laboratory

SCOUTS

The World Association of Girl Guides and Girl Scouts (WAGGGS) and the World Organization of the Scout Movement (WOSM) endorse this educational badge framework for use by Guides and Scouts around the world, adapting it as necessary to their local needs and requirements.

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS | 2013

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WELCOME

“The ocean covers 70 percent of the Earth’s surface, and is essential for life on our planet – even for those of us who live nowhere near the sea!”

It provides us all with food and other materials that we need, regulates our climate and provides half of the oxygen we breathe. The ocean also offers us various means of transport and opportunities for recreation. People have long thought that the ocean was so wide and bountiful that it would go on supplying our needs forever, but this is not the case: human activities are causing significant damage to life in the ocean. People are often unaware of the problems created by this heavy reliance, as few of us have the opportunity to look beneath the surface of the sea and see the damage that our actions have caused.

This is where the Ocean Challenge Badge comes in: let it take you on a journey to discover the ocean! It is packed with activities to help you learn about how the ocean works, the creatures that live in it, and just how important it is in our everyday lives. You will also discover how YOU can play a role in protecting our ocean for future generations. We hope you will be inspired to take the challenge and celebrate our ocean.”

YUNGA AMBASSADORS

Anggun

Carl Lewis

Debi Nova

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Lea Salonga

Nadeah

Noa (Achinoam Nini)

Percance

Valentina Vezzali

BE SAFE AND SOUND!

DEAR LEADER OR TEACHER,

The challenge badges are designed to support you in undertaking educational activities. However, as you will be implementing these activities in different contexts and environments, it is up to you to ensure that the activities you choose are appropriate and safe.

Being by, on or in the sea can be a fantastic and exciting experience for your group, but you do need to be vigilant.

The Marine Life Information Network for Britain and Ireland has put together a seashore code containing advice on how to look after yourself and to protect the animals and plants that live on the shore (www.marlin.ac.uk/pdf/seashorecode.pdf). It says:

* Before you go, tell someone where you are going, when you will be back and make sure you know what the weather and tides will be like. If you can, take a mobile phone.
* Walk carefully over rocks, they may be slippery or unstable. Cliffs should also be avoided as they may be unstable.
* Do not take living plants or animals home with you. If you do take shells home, make sure they are empty.
* Take your litter home, it can be dangerous to people and wildlife and can ruin the scenery you are there to enjoy.
* Report anything unusual that you find, but do not touch anything unless you are sure it is safe.
* Treat all living things with respect and replace any stone or seaweed exactly where you found it.
* Wash your hands before you eat and when you get home!

The sea can be an unpredictable place and it is up to you to make sure you have enough adult support to keep participants safe. You also need to make sure that you don't hurt the marine environment. Remember: "take only pictures and leave only footprints". Please consider the general precautions in the boxes below and carefully evaluate which other safety issues need to be taken into consideration before undertaking any activity.

A few additional tips should also help to keep you safe:

* Avoid muddy shores as you can easily get stuck in the mud.
* Watch out for waves, especially near rocks, as they can be bigger and more powerful than you think.
* If there are any warning signs on the beach or coast (such as beach closed or no swimming), make sure you follow the advice.
* If you want to swim, don't go into the water unsupervised and, if possible, only swim at beaches where there is a lifeguard on patrol. Make sure you know where other people in your group are.
* Don't swim immediately after a meal.
* Don't swim near pipes, outflows, rocks, breakwaters and piers and don't use them to jump off.
* If you get into trouble in the water, don't panic; raise one arm up and float until help arrives. If you find you are in a rip current or undertow, float with it; don't try to swim against it.
* Only use a snorkel if you are a good swimmer and the water is calm.
* Take a first aid kit with you, just in case.
* In some activities, you have the option of uploading pictures or videos to the internet on Web sites such as YouTube. Always make sure that everyone in the pictures or video, and/or their parents, have given their permission before you post anything online.

THE CHALLENGE BADGE SERIES

Developed in collaboration with United Nations agencies, civil society and other organizations, the United Nations challenge badges are intended to raise awareness, educate and motivate young people to change their behaviour and be active agents of change in their local communities. The challenge badge series can be used by teachers in school classes, youth leaders and especially Guide or Scout groups.

To see existing badges go to www.yunga-un.org. To receive updates on new releases and other YUNGA news, register for the free YUNGA newsletter by emailing yunga@fao.org.

YUNGA has or is currently developing badges on the following topics:

AGRICULTURE: How can we grow food in a sustainable way?

BIODIVERSITY: Let's make sure no more of the world's glorious animals and plants disappear!

CLIMATE CHANGE: Join the fight against climate change and for a food secure future!

ENERGY: The world needs a healthy environment as well as electricity – how can we have both?

FORESTS: Forests provide homes for millions of plant and animal species, help regulate the atmosphere and provide us with essential resources. How can we ensure they have a sustainable future?

GOVERNANCE: Discover how decision-making can affect your rights and equality between people around the world.

HUNGER: Having enough to eat is a basic human right. What can we do to help the 1 billion people who still go hungry every day?

NUTRITION: What is a healthy diet and how can we make food choices which are environmentally friendly?

OCEAN: The ocean is mesmerizing and amazing. It helps regulate temperatures on Earth, provides us with resources and much, much more.

SOILS: Without good soil, nothing grows. How can we take care of the ground under our feet?

WATER: Water is life. What can we do to safeguard this precious resource?

CREATING BEHAVIOUR CHANGE

We work with young people because we want to support them in leading fulfilling lives, help them prepare for their futures, and for them to believe that they can make a difference in the world. The best way to make this difference is by encouraging young people to embrace long-term behaviour change. Many current social and environmental problems are caused by unhealthy or unsustainable human behaviour. Most people need to adapt their behaviour, and not just for the duration of a project such as working on this badge, but for life. Young people know more about these issues than ever before, but still behave in detrimental ways. It is clear that simply raising awareness is not enough to change behaviour.

So what can you do?

There are some proven ways of promoting behaviour change, so to increase the long-term impact of this challenge badge, try to do the following:

FOCUS ON SPECIFIC, ACHIEVABLE BEHAVIOURAL CHANGE Prioritize activities which target very clear and specific behaviour change (e.g. 'buy and eat ecolabelled fish' rather than 'help protect fish stocks').

ENCOURAGE ACTION PLANNING AND EMPOWERMENT Put young people in charge: let them choose their own activities and plan how to carry them out.

CHALLENGE CURRENT BEHAVIOUR AND TACKLE BARRIERS TO ACTION Encourage participants to scrutinize their current behaviour and think about how it could be changed. Everyone has excuses for why they don't behave in a particular way; lack of time, lack of money, not knowing what to do... the list goes on. Encourage young people to voice these excuses and then find ways around them.

PRACTISE ACTION SKILLS You'd like to take public transport more often? Collect and practise reading timetables, plot out routes on a map, take a walk to the bus stop, find out what the fare is, do a trial journey. You'd like to eat more healthily? Try lots of healthy foods to see which you like, experiment with recipes, learn how to read food labels, create meal planners, visit the shops or local markets to find healthy food choices. Keep practising until it becomes a habit.

SPEND TIME OUTDOORS No one is going to look after something they don't care about. Time spent in natural environments – whether that is the local park or a pristine wilderness – encourages an emotional connection with the natural world which is proven to lead to more pro-environmental behaviour.

GET FAMILIES AND COMMUNITIES INVOLVED Why change the behaviour of just one young person when you could change the behaviour of their entire family, or even the whole community? Spread your message more widely, encourage young people to pester their family or friends to join in and showcase what you have been doing for the local community. For an even bigger impact, get political and lobby your local or national government.

MAKE A PUBLIC COMMITMENT People are far more likely to do something if they agree to do it in front of witnesses or in a written statement – why not take advantage of this?

MONITOR CHANGE AND CELEBRATE SUCCESS Behaviour change is hard work! Revisit tasks regularly to monitor achievement and reward continued success in an appropriate way.

LEAD BY EXAMPLE The young people you work with look up to you. They respect you, care about what you think and want to make you proud. If you want them to embrace the behaviour you are advocating, then you must lead by example and make those changes yourself.

TIPS ON UNDERTAKING THE BADGE WITH YOUR GROUP

In addition to the suggestions above encouraging behavioural change, the following ideas are intended to help you develop a programme to undertake the challenge badge with your group.

STEP 1 INVESTIGATE

Before and while carrying out the activities included in this booklet, encourage your group/class to learn about the ocean and the life that it contains, how humans use the ocean and how human activities are changing it. You could start by finding out when your group's members last visited the coast, what they did there and what they liked and disliked about the experience. Get them thinking about other people they saw by the sea and how they were using it – did they see anyone fishing? Were there boats or ships on the horizon? What else was going on? Explain how some of these activities can influence the quality of the marine environment and the organisms that live there. Also talk about how what we do on land influences what goes on in the ocean. Finally, discuss with the group how our individual choices and actions may affect the ocean, and what we can do to help make a positive difference.

STEP 2 SELECT

Apart from the compulsory activities, which ensure that participants understand basic concepts and issues related to the ocean, participants are encouraged to select the activities that best match their needs, interests and culture. As far as possible, let the participants choose which activities they want to do. Some activities can be done individually, others in small groups. If you have another activity that is relevant or particularly appropriate to your area, you may also include it as an additional option.

STEP 3 ACT

Allow enough time for the group to carry out the activities. Support and guide them through the process but make sure they carry out their tasks as independently as possible. Many activities can be conducted in several different ways. Encourage participants to think and act creatively when undertaking their activities.

STEP 4 DISCUSS

Have participants present the results of their challenge badge activities to the rest of the group. Do you notice any changes in their attitudes and behaviour? Encourage participants to think about how their daily activities both depend upon and affect the ocean. Discuss the experience and reflect on how they can continue to apply it in their lives.

STEP 5 CELEBRATE

Organize a celebration for those who successfully complete the badge curriculum. Invite families, friends, teachers, journalists and community leaders to participate in the celebration. Encourage your group to present the results of their project to the community in a creative way. Award them with certificates and challenge badges (see page 148 for details).

STEP 6 SHARE WITH YUNGA!

Send us your stories, photos, drawings, ideas and suggestions: **yunga@fao.org**

BADGE STRUCTURE AND CURRICULUM

The Ocean Challenge Badge has been developed to help inform children and young people about the crucial role the ocean plays on our planet. This booklet will help you develop an appropriate, enjoyable and engaging educational programme for your class or group.

The first part of the booklet provides **background information** on relevant educational topics, aiming to help teachers and youth leaders prepare their sessions and group activities without having to search for the information. Contents include the ways in which the ocean moves; how it supports life both underwater and on land; how certain human activities may harm the ocean; and how we can all help to prevent this. Naturally, not all the materials will be required or appropriate for all age groups and activities. Leaders and teachers should therefore select the topics and level of detail most appropriate for their group.

The second part of the booklet contains the **badge curriculum**, a range of activities and ideas to stimulate learning and motivate children and young people to help protect Earth's coasts and the ocean. The activities include options for ocean enthusiasts but also allow young people to learn about the ocean even if they don't live near the coast. A checklist to help participants keep track of the activities they have completed is provided at the end of the curriculum. Additional resources, useful Web sites and a glossary explaining key terms (which are highlighted in the text like **this**) are provided at the end of the booklet.

Badge structure

For ease of use and to ensure that all the main topics are addressed, both the background information (pp.24-95) and the activities (pp.96-145) are divided into five main sections:

A. OCEAN IN MOTION: introduces seawater, its movements and how these movements influence local weather conditions as well as the global climate.

B. THE OCEAN IS LIFE: explores marine species, ecosystems and habitats from the shallows to the deep sea.

C. PEOPLE AND THE OCEAN: discusses the many ways in which people explore and use the coasts and seas.

D. THE OCEAN AT RISK: outlines how human actions negatively affect the ocean and ocean life.

E. TAKE ACTION: talks about how humans can interact more sustainably with the ocean and suggests ideas for how your class or group can help protect it.

Requirements: To earn the badge, participants must complete one of the two compulsory activities presented at the beginning of each section, plus (at least) one additional activity from each section, chosen individually or as a group (see graphic on p.16). Participants can also complete additional activities considered appropriate by the teacher or leader.

Section A: OCEAN IN MOTION

1 compulsory activity (A.1 or A.2) & at least 1 optional activity (A.3 - A.17)

+

Section B: THE OCEAN IS LIFE

1 compulsory activity (B.1 or B.2) & at least 1 optional activity (B.3 - B.12)

+

Section C: PEOPLE AND THE OCEAN

1 compulsory activity (C.1 or C.2) & at least 1 optional activity (C.3 - C.12)

+

Section D: THE OCEAN AT RISK

1 compulsory activity (D.1 or D.2) & at least 1 optional activity (D.3 - D.10)

+

Section E: TAKE ACTION

1 compulsory activity (E.1 or E.2) & at least 1 optional activity (E.3 - E.8)

=

Ocean Challenge Badge
COMPLETED!

Age ranges and appropriate activities

To help you and your group select the most appropriate activities, a coding system is provided to indicate the age group(s) for which each activity is most suitable. Next to each activity, a code (for example 'Levels 1 and 2') indicates that the activity should be suitable for five to ten year olds and eleven to fifteen year olds.

However, please note that this coding scheme is only indicative. You may find that an activity listed at one level is suitable for another age group in your particular circumstances. As teachers and youth leaders you should use your judgement and experience to develop an appropriate curriculum for your group or class. This could incorporate additional activities not listed in this booklet, but which allow you to achieve all the educational requirements.

LEVEL

1 **Five to Ten years old**

2 **Eleven to Fifteen years old**

3 **Sixteen plus years old**

REMEMBER!

The key objectives of the challenge badge are to educate, inspire, stimulate interest in the big blue sea and above all, motivate individuals to change their behaviour and promote local and international action. However, most of all, the activities should be **fun**! Participants should enjoy the process of earning the badge and learning about the ocean and its importance.

SAMPLE BADGE CURRICULA

The sample curricula for the different age groups below provide examples of how the badge could be earned and are intended help you develop your own programme.

LEVEL

1 **Five to Ten years old**

2 **Eleven to Fifteen years old**

3 **Sixteen plus years old**

Each activity has a specific learning objective, but in addition to this, children will also be expected to learn more general skills including:

* TEAMWORK
* IMAGINATION AND CREATIVITY
* OBSERVATION SKILLS
* CULTURAL AND ENVIRONMENTAL AWARENESS
* NUMERICAL AND LITERACY SKILLS

SECTION	ACTIVITY	LEARNING OBJECTIVE
A Ocean in motion	**A.1: Our Ocean** (p.97)	To appreciate the importance of the ocean.
	A.4: Make a Cloud (p.99)	To learn about evaporation and condensation.
B The ocean is life	**B.1: Ocean Life** (p.111)	To learn the names of different marine creatures.
	B.5: Underwater Model (p.114)	To explore the life and physical features found near and on the deep seabed.
C People and the ocean	**C.2: Seaside Fun** (p.122)	To investigate seaside recreation and its impacts.
	C.3: Ocean Use Scrap-Book (p.123)	To reflect on how many everyday objects and activities are linked to the ocean.
D The ocean at risk	**D.1: Smaller Footprints** (p.131)	To cut down on greenhouse gas emissions wherever possible.
	D.3: Rising Temperatures, Rising Seas (p.132)	To understand the different impacts of melting sea ice and melting glaciers.
E Take action	**E.2: Ocean Campaign** (p.140)	To raise awareness about ocean issues in the wider community.
	E.3: Bag It! (p.141)	To cut down the use of plastic.

LEVEL

1 Five to Ten years old

2 **Eleven to Fifteen years old**

3 Sixteen plus years old

As in Level 1, each activity in Level 2 has a specific learning aim, but also fosters additional, more general skills including:

* TEAMWORK AND INDEPENDENT STUDY SKILLS
* IMAGINATION AND CREATIVITY
* OBSERVATION SKILLS
* CULTURAL AND ENVIRONMENTAL AWARENESS
* NUMERICAL AND LITERACY SKILLS
* RESEARCH SKILLS
* PRESENTATION AND PUBLIC SPEAKING SKILLS
* THE ABILITY TO PRESENT AN ARGUMENT AND DEBATE

SECTION	ACTIVITY	LEARNING OBJECTIVE
A Ocean in motion	**A.2: Seawater Experiments** (p.97)	To understand how salt content and water temperature affect water density.
	A.16: Rubber Ducks (p.108)	To express an understanding of ocean currents creatively.
B The ocean is life	**B.2: Coast Visit** (p.111)	To research which marine creatures live in the local coastal area.
	B.6: Who Eats Whom? (p.115)	To explain the relationships between different marine plants and animals.
C People and the ocean	**C.1: Fishy Business** (p.121)	To think about the origins of seafood and its impacts on the environment.
	C.6: Boats and Seafarers (p.125)	To reflect on marine exploration.
D The ocean at risk	**D.1: Smaller Footprints** (p.131)	To cut down on greenhouse gas emissions wherever possible.
	D.5: Ocean Acidification (p.133)	To discover the effects of higher water acidity levels on marine life.
E Take action	**E.2: Ocean Campaign** (p.140)	To raise awareness about ocean issues in the wider community.
	E.6: Citizen Science (p.143)	To contribute to a research project by providing data.

LEVEL

1 Five to Ten years old

2 Eleven to Fifteen years old

3 Sixteen plus years old

General skills a Level 3 curriculum seeks to develop include:

* TEAMWORK AND INDEPENDENT STUDY
* IMAGINATION AND CREATIVITY
* OBSERVATION SKILLS
* CULTURAL AND ENVIRONMENTAL AWARENESS
* TECHNICAL SKILLS AND THE ABILITY TO RESEARCH COMPLEX ISSUES
* PRESENTATION AND PUBLIC SPEAKING SKILLS
* THE ABILITY TO PRESENT AN ARGUMENT AND DEBATE

SECTION	ACTIVITY	LEARNING OBJECTIVE
A Ocean in motion	**A.1: Our Ocean** (p.97)	To appreciate the importance of the ocean.
	A.12: Tsunami Broadcast (p.104)	To investigate the causes of tsunamis and practise interview skills.
B The ocean is life	**B.2: Coast Visit** (p.111)	To research which marine creatures living in the local coastal area.
	B.9: Film the Coast (p.118)	To produce a short documentary about an ocean issue.
C People and the ocean	**C.2: Seaside Fun** (p.122)	To investigate seaside recreation and its impacts.
	C.5: A Day in the Life of a Fisher (p.124)	To learn about the routines and responsibilities of fishers.
D The ocean at risk	**D.2: Marine Media** (p.131)	To report on how human activity is changing a local marine environment.
	D.9: MPA Debate (p.137)	To explore the pros and cons of Marine Protected Areas and exercise debating skills.
E Take action	**E.1: Beach Clean** (p.139)	To organize a beach clean and informational display about coastal and marine pollution.
	E.4: Sustainable Seafood (p.141)	To understand how everyday seafood choices can help or harm marine ecosystems.

OCEAN IN MOTION

Despite the fact that over 70 percent of the Earth's surface is covered by the ocean, we often don't realize how essential the ocean is in our daily lives, even for those of us who don't live anywhere near it. Here are some key reasons why the ocean is so important for life on Earth:

* Over 4 billion years ago, life began in water.
* The ocean gives us more than half of the oxygen we breathe.
* It is a vital source of food and raw materials (like medicines or building materials such as sand, gravel or gypsum).
* The ocean has a huge influence on our **weather** and **climate**.
* It is the ultimate transport superhighway, because 90 percent of international trade is shipped all across the world over the ocean (*Source*: IOC-UNESCO).
* The ocean has the potential to produce a considerable amount of the energy that we need.
* Millions of people depend on the coast and the **seas** for their living and millions use coasts and the **seas** for leisure and recreation.

Watch this video by National Geographic to inspire you as you start discovering the wonders of the ocean:

www.youtube.com/watch/?v=ycHt8De_S1w

HOW MANY OCEANS ARE THERE?

First things first: the global ocean is really one big interconnected body of water, which is why this challenge badge is called the Ocean Badge. However, we tend to refer to its basins as five smaller oceans (listed with the biggest first): the *Pacific Ocean*, the *Atlantic Ocean*, the *Indian Ocean*, the *Southern Ocean* and the *Arctic Ocean*.

Many people use the words 'ocean' and '**sea**' interchangeably, but there is actually a difference. **Seas** (e.g. the Caribbean Sea and the Mediterranean Sea) are smaller than the oceans and are usually enclosed by land on more than one side. Other types of salty water bodies include **straits** (e.g. the Bering Strait between Alaska and Siberia, and the Strait of Malacca between mainland Malaysia and Sumatra), **bays** (e.g. the Bay of Bengal) and **gulfs** (e.g. the Gulf of Mexico). There are also a number of salt lakes which are also known as **inland seas** (e.g. the Aral Sea and the Caspian Sea).

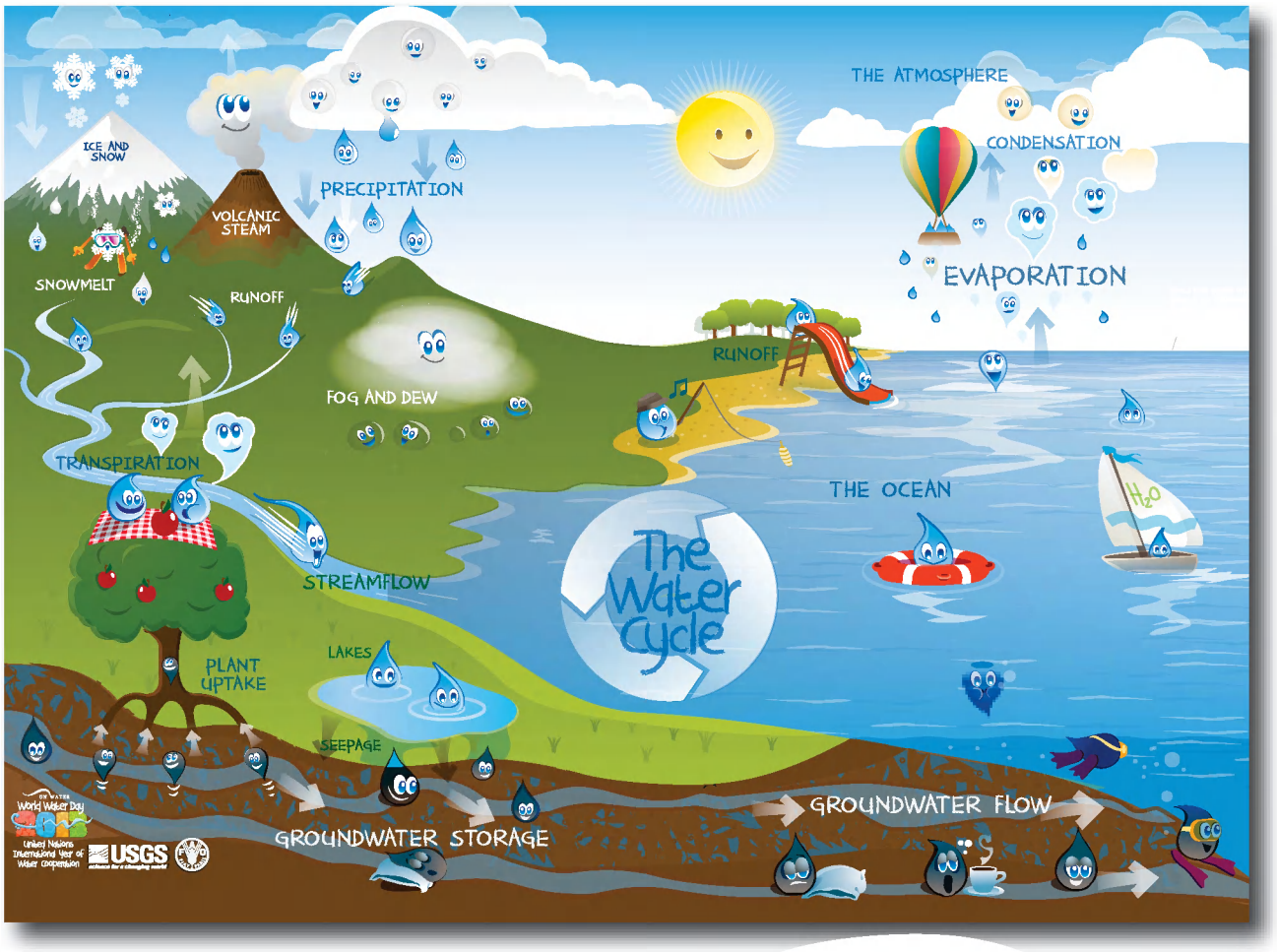
SALTY WATER

If you've ever tasted **seawater**, you know it tastes salty. We humans certainly couldn't survive in the water – we can't even drink it! The **fresh water** we drink contains dissolved salts and minerals too (but only about 1 g per litre of **fresh water**), but this is far less than **seawater** (which on average has 35 g per litre – that's about 6 teaspoons of salt). These dissolved salts make **seawater** denser (heavier) than **fresh water**, and make it freeze at a lower temperature (-2 °C compared to 0 °C).

Where do these dissolved salts in **seawater** come from? A lot of them are picked up as **fresh water** moves through or over land in streams, rivers or as **groundwater**, and are eventually carried out to sea. As **seawater** **evaporates** (as part of the **water cycle**), only the water turns to vapour, leaving behind its dissolved salts. Over time, more and more salts are left behind, making the water saltier. Scientists also believe that salts entered the sea from the seabed when the ocean formed and from underwater **volcanoes** and **hydrothermal vents**.

POOJA MURALI MURUGAN, aged 6, QATAR

However, not all **seawater** has the same **salinity** (saltiness); it varies according to the amount of **fresh water** entering the ocean (e.g. from rivers) and how much water is turning into vapour because of **evaporation**. The **salinity** of different parts of the ocean influences which marine **species** can live there.



DID YOU KNOW?

If there is a lot of rain, rainwater will initially float on top of the **seawater** because it is less dense (lighter). Eventually though, the ocean's waves will mix the rainwater into the ocean, **diluting** the **seawater** a little (making it a bit less salty).

Where the Mississippi River meets the sea, so much **fresh water** flows into the sea that it hardly mixes at all: the **fresh water** floats on top of the **seawater** and this layer just gets thinner and thinner as you move further out to sea.

WHO CAN DRINK SEAWATER?

What happens if we drink salt water? We humans need some salt in our bodies, but there is too much salt in **seawater** for our bodies to handle. To get rid of the extra salt, we would need to urinate more water than the amount of **seawater** that we drank in the first place. That would mean we'd become thirstier and thirstier and we would ultimately die of dehydration!

Some plants and animals have developed clever ways of being able to drink salty water. For example, fish get rid of the salt they don't need through their gills. Mangrove trees can prevent some salt from entering through their roots when they **absorb seawater**, and can get rid of any extra salt through their leaves. Seabirds also drink salt water, and actually shake or sneeze out excess salt through special 'salt glands' in their beaks!

Find out more:

http://oceanservice.noaa.gov/facts/whysalty.html

WAVES

The effect of the wind blowing over the ocean's surface causes waves. Waves can travel over the ocean for thousands of miles and can vary in size from a few centimetres to over 30 m! They break when the waves reach the shallow waters of the coast, where over the centuries, wave **erosion** has shaped coastlines. Large waves may be a hazard to fishers and sailors, but surfers enjoy riding them, so breaking waves can actually be a hugely important source of income in coastal areas. For example, it has been estimated that surfing contributed US$207 million to Costa Rica's economy in 2006.

The wind is not the only force that creates waves. **Tsunamis** are a different sort of wave resulting from massive movements in the seabed (e.g. an underwater **earthquake** or **volcanic** eruption).

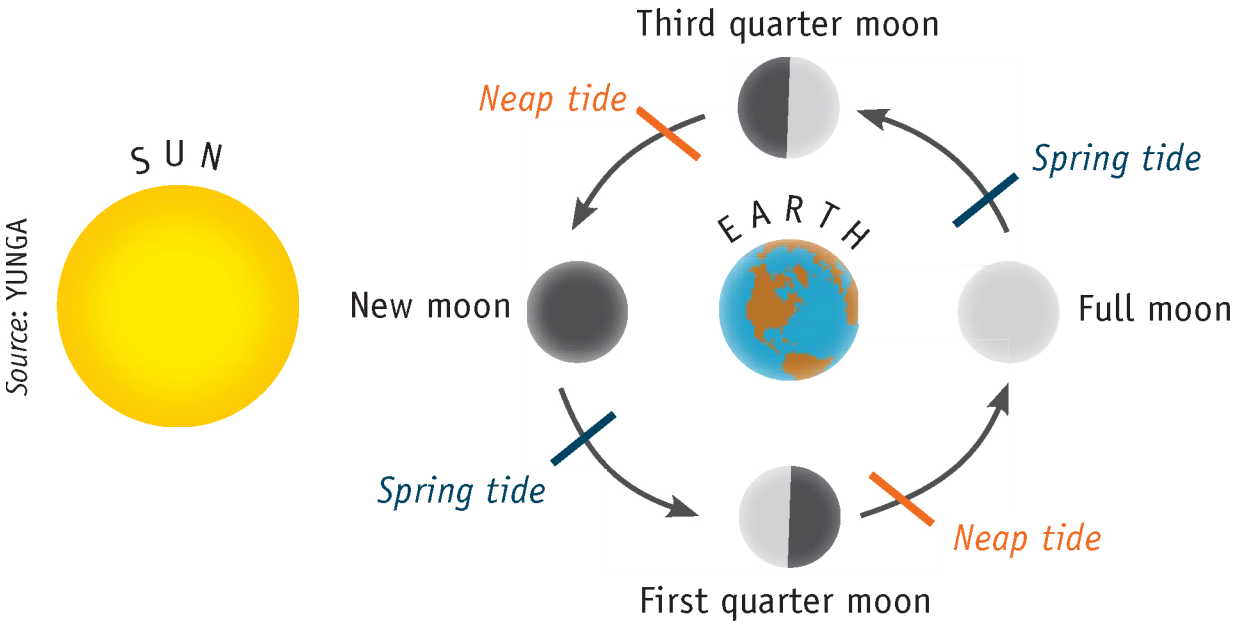
Tsunamis can also be caused by landslides. We may not be able to see that a landslide has taken place underwater, but **tsunamis** can often be recognized as very powerful waves that increase dramatically in size as they approach shallow waters. They can have particularly devastating effects once they reach the coast (e.g. the Asian **tsunami** of 2004 and the Japanese **tsunami** of 2011).

Find out more:

www.actionsportsmaui.com/asmf_how_waves_are_made.html

http://environment.nationalgeographic.com/environment/natural-disasters/tsunami-profile

TIFFANY EL GÓMEZ LAZO, aged 20, PERÚ



TIDES

The ocean is never still. At an even bigger scale than waves, the level of the sea rises and falls all around the world as a consequence of the tides. **Tides** are mainly caused by the gravitational pull of the Moon and the Sun on Earth. Most places around the world have two low and two high **tides** each day, although some places only get one of each. The difference between the highest and lowest tide (called the **tidal range**) varies over a two-week cycle. The periods of greatest **tidal range** are called **spring tides**, while those when the range is smallest are called **neap tides**.

Understanding the **tides** is also very important for sailors and fishers, as it influences how and when they can move their boats, and also determines when, and for how long, fishers can collect **species** like mussels and whelks that are exposed on the seabed when the tide is out. As we will see in Section B, intertidal areas (areas between the highest and lowest tide marks) are **habitats** that are rich in **biodiversity**.

Find out more:

www.youtube.com/watch?v=KBTsESF1w-I

www.seaworld.org/wild-world/ecosystems/info-books/tide-pools/intertidal-ecology.htm


DANIELA BORISLAVOVA KARATIVANOVA, aged 19, BULGARIA

CURRENTS

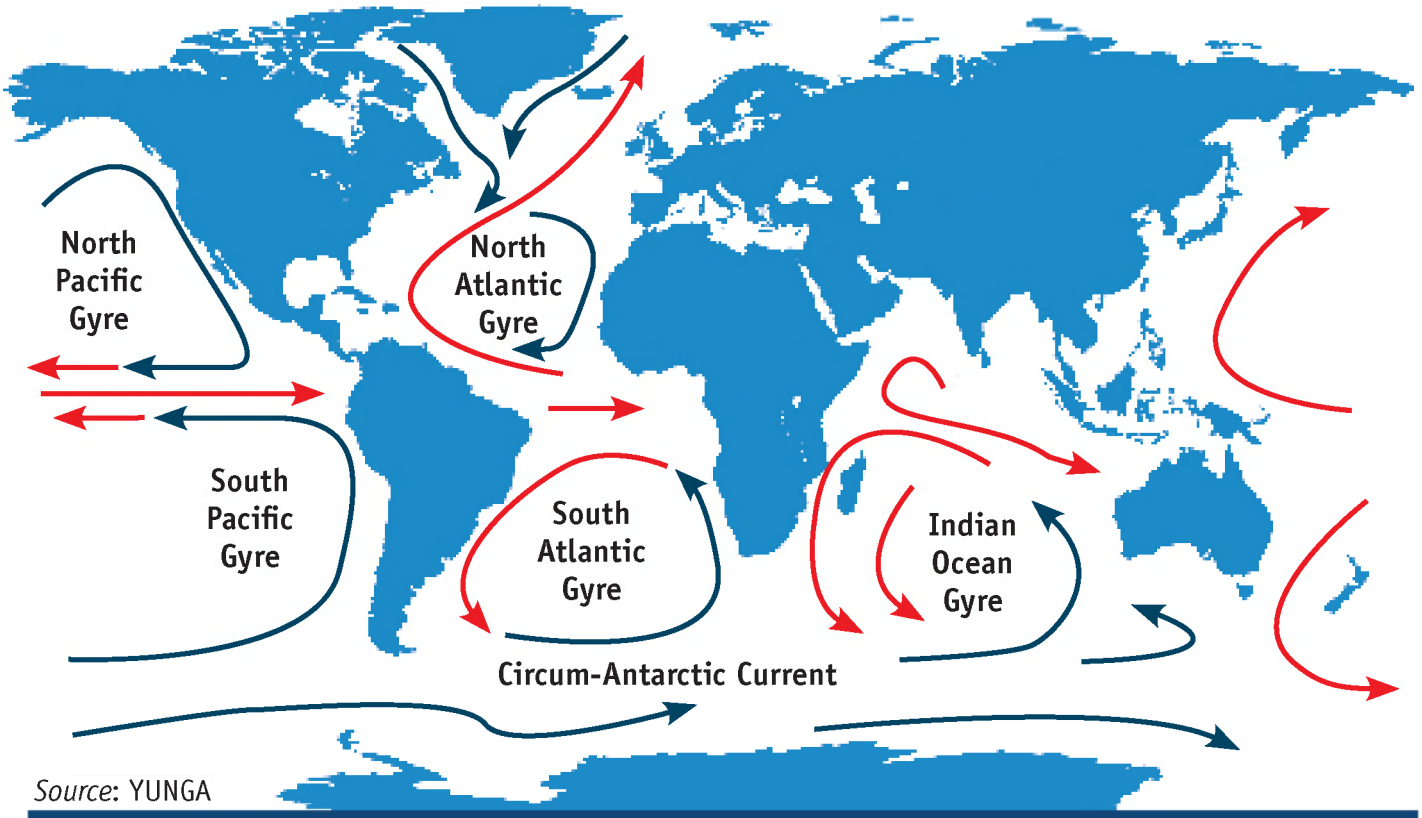
At the largest scale of the ocean's motions, **seawater** also moves in **currents**. These are continuous movements of water in a particular direction. There are two different kinds of **currents**:

1. **Surface currents**, which are driven by the wind and can affect the movement of the ocean down to a depth of 400 m. Earth's major **surface currents** always flow in the same directions: clockwise in the northern hemisphere and anticlockwise in the southern. These regular movements have been marked on navigation charts, helping sailors for hundreds of years to manoeuvre their boats.

2. **Deep ocean currents**, which are driven by water temperature and **density**. Colder and saltier waters are heavier so they sink, while warmer, less salty waters rise. This leads to a continuous cycle of rising warmer waters and sinking cooler waters, as water near the ocean's surface cools down and sinks again. The journey of seawater around the global ocean is very important for the distribution of heat around the planet, and thereby influences local **weather** and global **climate** patterns.

DID YOU KNOW?

The **Gulf Stream** is a warm ocean current that makes the waters of the North East Atlantic warmer than those of the North West Atlantic. This makes the **climate** of the United Kingdom and parts of Northern Europe warmer than that of equivalent **latitudes** in North America.



Source: YUNGA

OCEAN CURRENTS

WATCH OUT!

Currents can move rather quickly. **Rip currents** in particular (narrow and fast moving belts of water that travel away from the coast), have put many swimmers and leisure seekers in distress along the coast. They often occur at low points along the beach (e.g. at a break in a sand bank) and are more likely to occur when the waves are high and frequent. It can be difficult to detect **rip currents**, but signs to look out for include:

* a line of **debris** or foam moving away from the beach;
* a break in the pattern of the waves arriving at the beach;
* choppy or churning water;
* an area of water that has a different colour to the rest.

Currents and life

Just as the wind helps to scatter pollen and certain plant seeds on land, **currents** help distribute marine **eggs**, **sperm** and **larvae**, as well as other microscopic marine creatures, making sure that life underwater goes on.

Find out more:

http://oceanservice.noaa.gov/education/tutorial_currents/welcome.html

www.ripcurrents.noaa.gov/overview.shtml

DO YOU KNOW THE DIFFERENCE BETWEEN THE WEATHER AND THE CLIMATE?

- **Weather** is fixed to a specific place and takes place within a fairly short time. For example, one day might be overcast and drizzly, another day could be sunny with fluffy clouds.
- **Climate** is what we call the average or typical **weather** conditions for a particular area. This 'area' could be single city (e.g. some regions have a dry, hot **climate** while others may be cool and rainy) – or the whole planet (e.g. we can calculate average global temperatures, or the average amount of rainfall globally).

Remember: Climate *helps you decide which clothes you need generally for where you live. Looking out of the window and seeing the* **weather** *helps you decide which of those clothes to wear each day!*

WEATHER

The ocean affects the local **weather** in a number of ways. For example, the Sun causes water from the ocean to evaporate as part of the **water cycle** (see graphic on p.27). The water vapour then condenses again in the air and forms clouds or fog. Depending on how cold it is in the atmosphere, this water falls back down to earth as rain, snow, hail or sleet.

There is also a **weather** pattern that can only form at sea: **hurricanes**. (Depending on where you live, **hurricanes** are also known as **typhoons** or **tropical cyclones**). These are violent storms that form over large areas of warm water in the **tropics**. They produce extremely strong winds, torrential rain, thunder and lightning and are associated with an uncommonly high rise in sea level, known as **storm surges**. The damages caused by **hurricanes** can be huge.

DID YOU KNOW?

Hurricane Mitch, which hit Honduras and Nicaragua in 1998, caused flooding and mud slides, and resulted in more than 19 000 deaths. **Hurricane** Katrina, which hit the Louisiana coastline of the USA in 2005, caused 1 836 deaths. **Hurricane** Sandy, which hit the Caribbean, the Mid-Atlantic and the Northeastern USA in October 2012, fortunately caused fewer deaths (though at least 250 people were killed). The costs of the damages, however, are estimated to be around US$66 billion.

CLIMATE

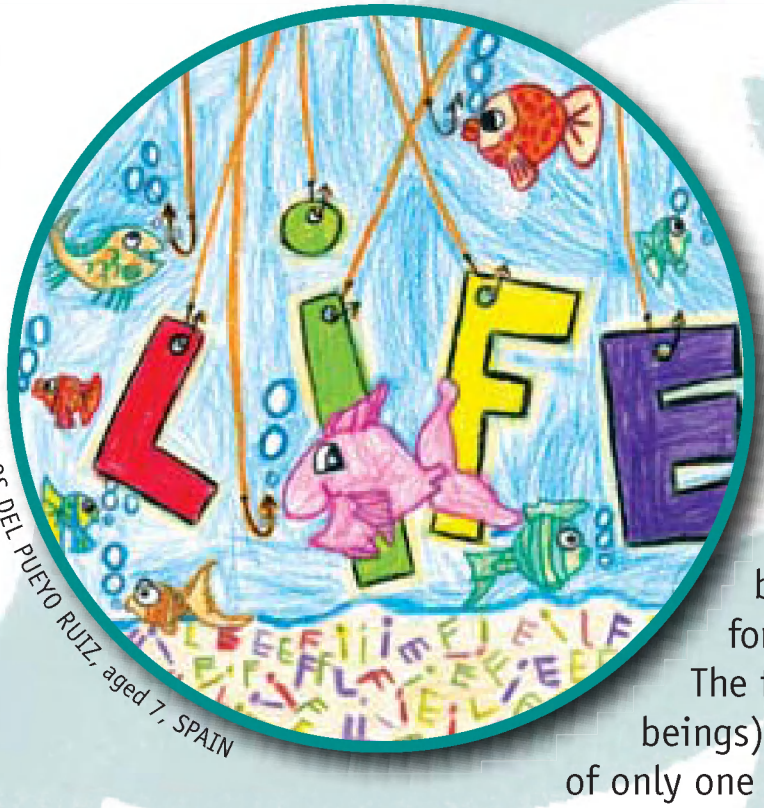
At the biggest scale, the ocean also has an important role in regulating the Earth's **climate**. It **absorbs**, stores and slowly releases large quantities of heat. This is why coastal areas have milder **climates** than landlocked continental areas. The ocean's **currents** also help distribute heat from the hot **tropics** to the cool poles. Because such a large proportion of our planet is **seawater** (over 70 percent), the ocean's warmth influences the Earth's **climate** as a whole. This close relationship between the ocean and our **climate** means that **climate change** has a huge effect on the ocean, its **ecosystems** and, as a result, our entire planet (find out more in Section D).

The ocean is also integral to the **monsoons**. The **monsoons** are changing winds which, in summer, bring heavy (and often much needed) seasonal rains to tropical and subtropical areas. In winter the land is colder than the sea, so dry, cold winds blow from the continent to the ocean. In summer, however, the system is reversed: the continent grows much warmer than the ocean, so the winds 'turn' and come in from the sea to the land. Now they carry all the water vapour which has **evaporated** from the sea, making the **weather** warm and humid, and causing heavy rains. When the **monsoon** fails and the rain does not arrive, as happened in India in 2009 for example, the effects on farming can be catastrophic.

Find out more:

http://oceanservice.noaa.gov/education/pd/oceans_weather_climate/welcome.html

THE OCEAN IS LIFE



CARLOS DEL PUEYO RUIZ, aged 7, SPAIN

WHERE IT ALL BEGAN

Most of us are much more familiar with the animals and plants on land than in the water. But in fact, over 4 billion years ago, the first life forms developed in the ocean! The first **organisms** (living beings) were microscopic, made up of only one cell each. Over many, many millennia these **organisms** became bigger and more complex, slowly becoming more like the plants and animals we know on land and in the water today. Today's ocean contains a huge diversity of life ranging from microscopic **organisms**, such as viruses and bacteria, to the largest animal on the planet, the blue whale. The exciting thing is that we keep discovering new marine **species**!

Find out more:

http://science.nationalgeographic.com/science/prehistoric-world/prehistoric-time-line

The Census of Marine Life

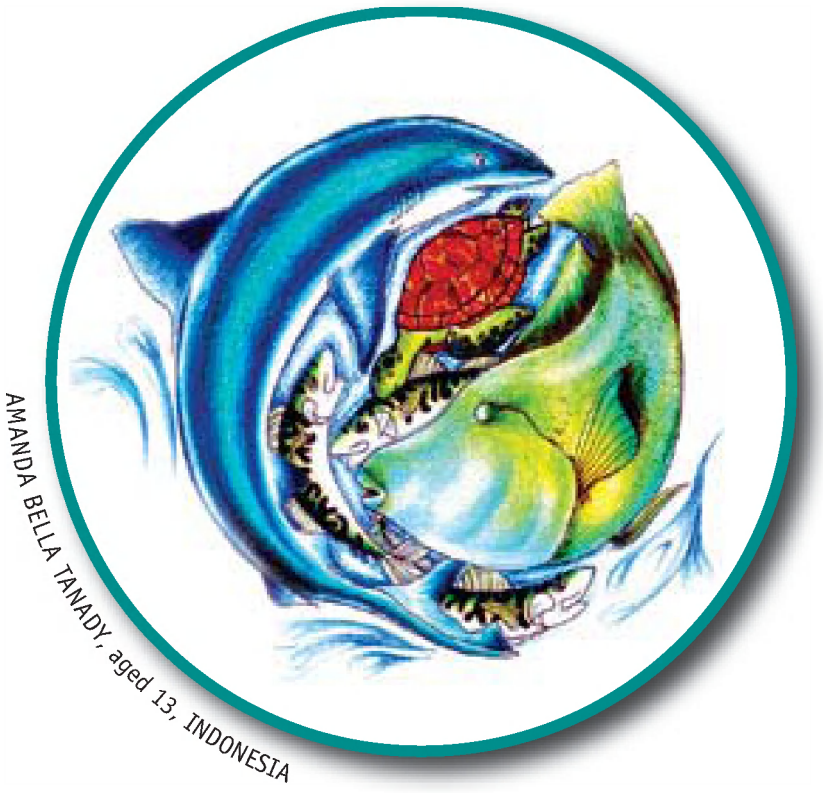
According to the Census of Marine Life, there are over 30 million marine **species**! The Census was a huge international research effort between 2000-2010 that created the world's biggest inventory of marine life. It looked at what **species** currently exist in the ocean, where and in what quantity, in order to better understand how marine life is changing. Its database contains entries from the North Pole to the South Pole, from the surface ocean to the deep sea, and of the smallest marine **organisms** (bacteria) to the largest (whales). The Census discovered more than 1 200 new **species**, and many underwater creatures are still being identified today! The information collected by the Census of Marine Life and other research efforts can now be found in the Ocean Biogeographic Information System (OBIS).

Find out more:

www.coml.org

http://news.nationalgeographic.com/news/2010/10/101004-census-of-marine-life-new-species-oceans-science/

www.iobis.org



AMANDA BELLA TANADY, aged 13, INDONESIA

OCEAN FOOD WEBS

As you may guess, all these marine **organisms** need to get their food from somewhere. So who eats what or whom? Let's take a look at how these relationships (known as **food chains** or **food webs**) work in the ocean!

At the bottom of most marine **food chains** or **food webs**, we find **primary producers** (plants and algae). **Primary producers** can make their own food by converting energy from the Sun into sugars through a process called '**photosynthesis**'. While they do this, they release oxygen (which is great for us humans, because we need oxygen to breathe!). Important **primary producers** include **phytoplankton** (tiny marine **organisms** that float in the ocean's **currents**) as well as seagrasses, kelps and other seaweed.

Primary producers are eaten by marine **herbivores**. **Herbivores** are animals which only eat plants. For example, sea urchins, periwinkles and limpets, mussels and oysters and some fish **species**, as well as larger animals such as manatees, are **herbivores**.

Many marine animals, however, eat other marine animals, making them **carnivores** or 'predators'. These include sharks, seals, some sea birds, some octopi, many fish **species** and many **molluscs**.

Then there are **omnivores**: animals which eat a mixture of plants and animals. Many whales, turtles, crabs and some sea birds are **omnivores**, for example.

Another important group are known as **detritivores** or scavengers. These animals feed on dead plants and animals. **Detritivores** include types of marine worms, crabs, starfish and fish. Many **species** of **detritivores** can be found in the depths of the ocean where light can't reach, so **primary producers** can't survive there and there is less competition. **Detritivores** live off the bodies of **organisms** that live higher up in the ocean and fall to the ocean floor when they die. Guess what this slow shower of bits of dead

plants and animals is called: **marine snow**... Eww, would you want to build a snowman out of that?

Find out more:

www.classroomatsea.net/general_science/food_webs.html

DID YOU KNOW?

Before the 1850s, most scientists thought that the ocean below 500 m must be lifeless because light couldn't reach it, temperatures were cold and the water pressure was so high. However, the HMS *Challenger*, a British Royal Naval vessel, travelled almost 130 000 km around the world between 1872 and 1876, with the crew surveying and exploring along the way, proving this assumption wrong. During the expedition, approximately 4 700 new **species** of marine life were discovered!

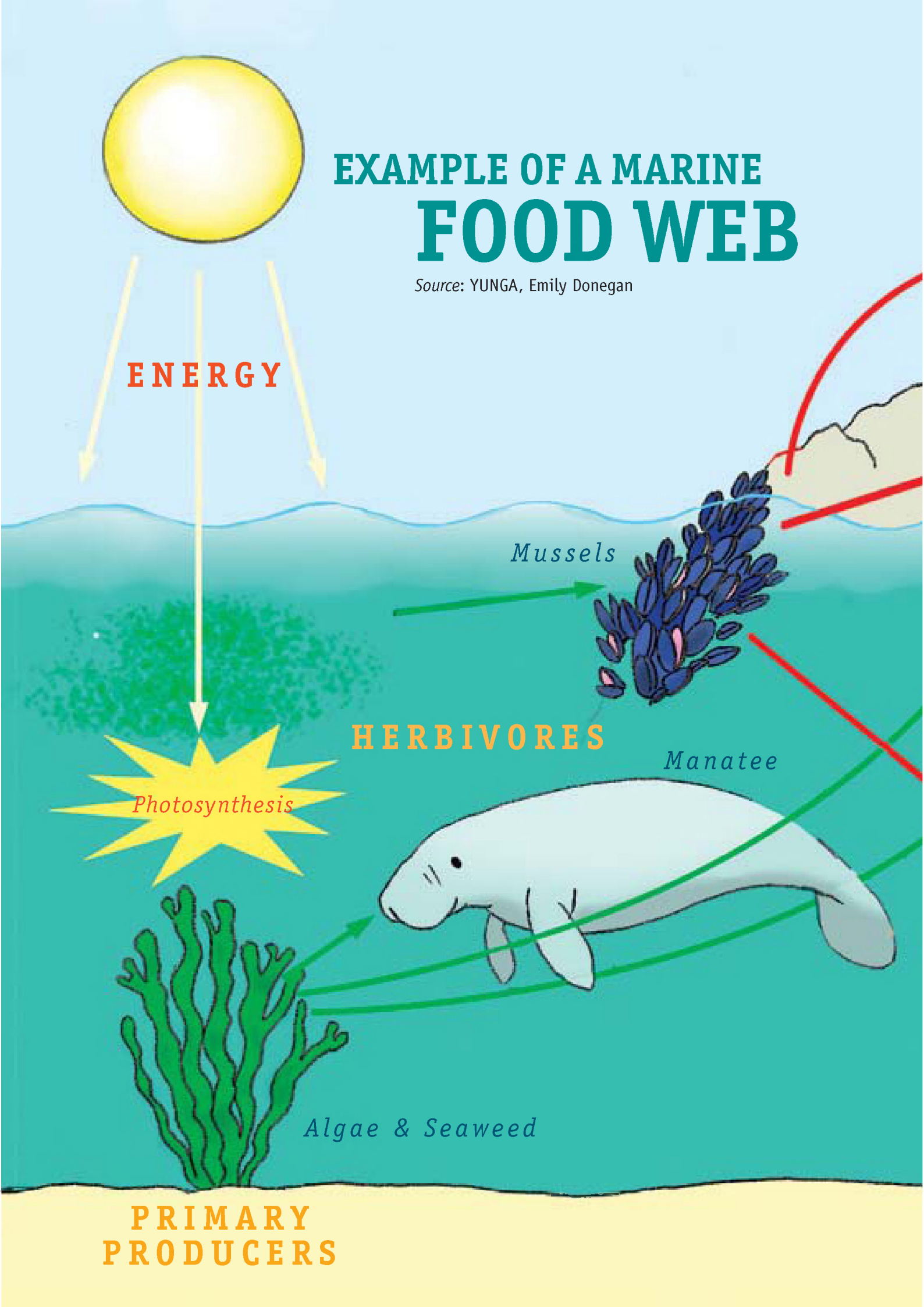
Since then, scientists have worked out that not all ocean **food chains** begin with **organisms** that use the Sun's energy to produce food (**photosynthesis**). There are some **organisms** which can convert chemicals that are released into the ocean by hydrothermal vents and **cold seeps** on the ocean floor into a source of food. This is called **chemosynthesis**.

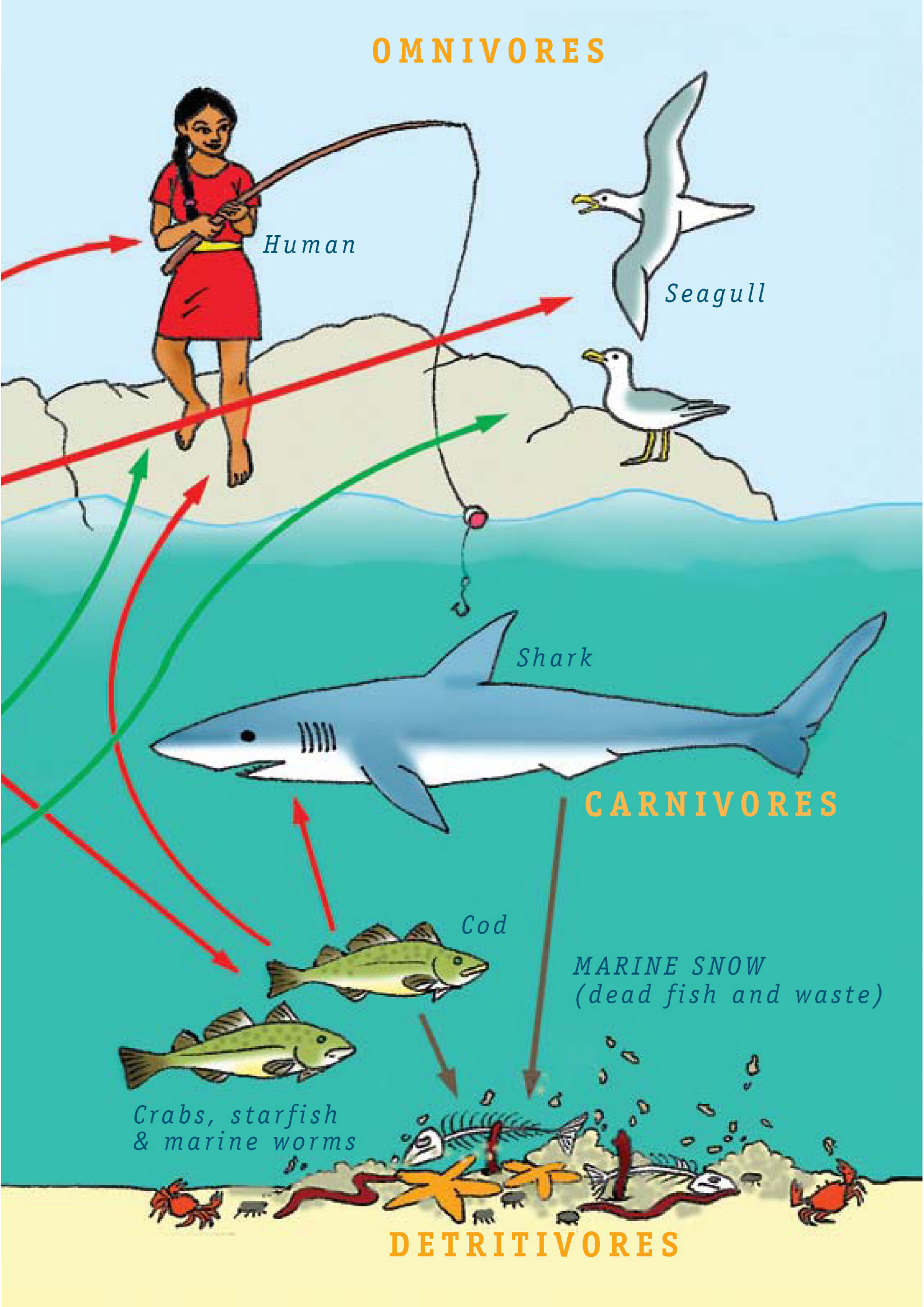
Find out more:

www.nhm.ac.uk/nature-online/science-of-natural-history/expeditions-collecting/hms-challenger-expedition/index.html

EXAMPLE OF A MARINE FOOD WEB

Source: YUNGA, Emily Donegan




OMNIVORES
Human
Seagull
Shark
CARNIVORES
Cod
MARINE SNOW
(dead fish and waste)
Crabs, starfish
& marine worms
DETRITIVORES

MARINE ECOSYSTEMS

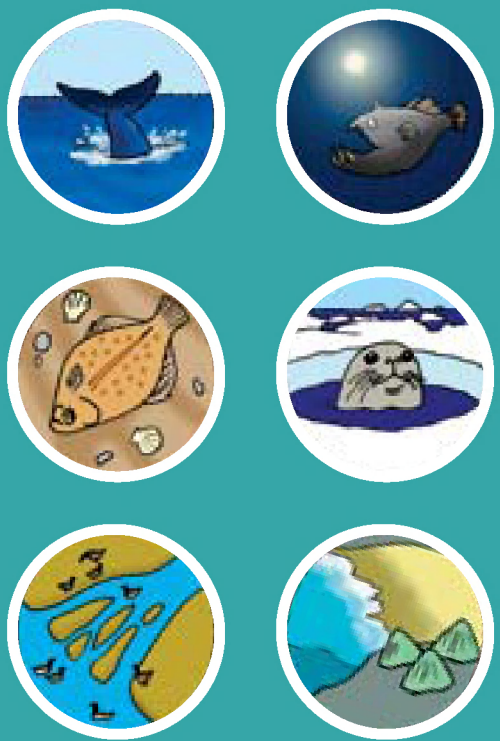
Food chains and **food webs** give you a good idea of how much all these marine **species** depend on each other. In fact, they don't only rely on each other for food; they are also all interconnected at a larger scale in their wider **ecosystems**.

'**Ecosystems**' are the surroundings and communities in which animals and plants live. The global ocean is one huge **ecosystem** in which every **organism** directly or indirectly relies on all the other parts of the community to survive (e.g. for food or shelter). So when a **species** becomes threatened or disappears altogether, other members of the **ecosystem** suffer too. This is why it is so important we take care that our activities don't harm the natural balance of life in the ocean.

AQIRA ZAHRA, aged 10, INDONESIA

MARINE HABITATS

Within an ecosystem on land or underwater, different organisms have particular 'homes' known as their 'habitat'.
Habitats can be defined according their physical characteristics but also according to their biological ones. Let's take a closer look at examples from both kinds of habitat.

PHYSICAL marine habitats	BIOLOGICAL marine habitats
	

Source: YUNGA, Emily Donegan

PHYSICAL marine habitats

'Physical' marine habitats are defined by their physical characteristics, like the habitat's temperature, salinity or the kind of rocks and sediment (e.g. sand, mud, clay or silt) that are available. Different physical characteristics are liked by different kinds of marine life, have different importance to us humans and are affected by our activities in different ways.

THE OPEN OCEAN

CHARACTERISTICS

The open ocean forms the largest part of the ocean. Light only enters the top 200 m of water and this is where most plant growth occurs (because there is light). It is an important habitat for fish and their predators (such as sharks), as well as whales and oceanic birds including puffins, albatross, petrels and shearwaters. Some marine organisms (such as phytoplankton) drift with the ocean currents while others are strong swimmers.

IMPORTANCE TO PEOPLE

As we have seen, the open ocean plays a vital role in the regulation of the global climate. People use the open ocean for fishing, transport and recreation.

FIND OUT MORE

http://wwf.panda.org/about_our_earth/blue_planet/open_ocean

THE DEEP OCEAN

CHARACTERISTICS

This is the lower part of the ocean beyond 200 m down, where little light reaches. Below about 500 m, oxygen levels become very low. Below 1000 m it is pitch black and you find no living plant life. Below 4 000 m, the water is extremely cold and under very high pressure. **Hydrothermal vents** provide important hotspots for a **food chain** that does not need light as an energy source. Marine life here has to be highly adapted. For example, some fish hardly move to cope with the low oxygen levels; many animals produce their own light; some **migrate** to the surface to feed at night and others feed on **marine snow**. Some animals have no eyes and their bodies are transparent... It's a creepy place!

IMPORTANCE TO PEOPLE

As technology to access it gets better, the deep ocean is becoming increasingly important for fishing and for bioprospecting (the search for new products and medicines).

FIND OUT MORE

www.nhm.ac.uk/nature-online/insite/discovering-understanding/F51

THE SEABED

CHARACTERISTICS

50 percent of the seabed is relatively flat and featureless (known as 'abyssal plain'). But the seabed also contains long chains of **seamounts** (e.g. the Mid Atlantic Ridge, which is up to 3 km high) with **volcanoes** and **hydrothermal vents** as well as deep trenches (the deepest is the Marianas Trench, which is about 11 km deep!).

IMPORTANCE TO PEOPLE

Shallow parts of the seabed support rich biological **habitats** such as coral **reefs**, seagrass meadows, **bivalve** beds and kelp forests that are important for fisheries. **Organisms** living here bury or break down our waste products, helping to keep the ocean healthy (though they can't keep up if we pollute it too much!). Nowadays, humans use the seabed to lay cables (e.g. for telecommunications), and explore the seabed to look for minerals, oil and gas. But you can also find fascinating artefacts from our past down there, like sunken pirate ships full of treasure...

FIND OUT MORE

www.bbc.co.uk/nature/habitats/Benthic_zone

THE FROZEN OCEAN

CHARACTERISTICS

Found in both the Arctic and Antarctic, sea ice covers 25 million square kilometres on average (about two and a half times the size of Canada!). Temperatures can fall well below -50 °C, and, in winter, there may be no daylight for long periods, only night! In summer, there are long days where the Sun doesn't set at all. The marine life found here is often specially adapted to the extreme cold: some animals' bodies contain substances to stop their blood from freezing, some have thick layers of fat or dense hair, while others **migrate** to warmer waters when the harsh winter arrives.

IMPORTANCE TO PEOPLE

These regions play a crucial role in regulating the global **climate** (see Section A). Sea ice is central to local human cultures and provides the habitat for the plants and animals they eat.

In 2012, the melting of the Arctic sea ice smashed all records. A Girl Guide and Girl Scout travelled on Greenpeace's ship *The Arctic Sunrise* to see what was happening with their own eyes. Watch their video 'Northbound' to learn more about why we need to protect the Arctic: **www.youtube.com/watch?v=5URk20xEHps**

FIND OUT MORE

http://nsidc.org/cryosphere/seaice/index.html

RIVER MOUTHS

CHARACTERISTICS

River mouths are found where rivers meet the sea. There are different kinds of river mouths, such as **estuaries** and **deltas**. River mouths support a great diversity of life as **nutrients** from both the river and the ocean come together here and are important areas for breeding fish and **migrating** birds. The animals and plants living here need to be adapted to changes in **salinity** and sediments brought by the rivers.

IMPORTANCE TO PEOPLE

River mouths are extremely important for us. They are very good for fishing and **aquaculture**, and are ideal transport hubs, allowing passage between the land and the sea. Settlements near river mouths tend to have grown quite large over the centuries, as trade into and out of their ports provided people with many opportunities to make a living. They are also essential for the environment: estuaries and **deltas** store a lot of carbon, they also protect the coast from storm damage, and the **organisms** living there can help break down waste products.

FIND OUT MORE

http://water.epa.gov/learn/kids/estuaries/index.cfm

http://oceanservice.noaa.gov/education/tutorial_estuaries

INTERTIDAL ZONES

CHARACTERISTICS

Intertidal zones are found at any part of the coast that the **tides** regularly expose and then cover again with water (e.g. rocky shores, mudflats, sandy beaches). Marine life here needs to be adapted to both dry and wet conditions, salty and **fresh water**, high and low temperatures – and to be able to hold on tight, to prevent being washed away by waves! Intertidal zones are very rich in **biodiversity**, and provide important **habitats** for breeding marine **species** (e.g. certain kinds of fish build their nests and raise their **fry** in little rocky caves that stay wet even when the **tide** is out).

IMPORTANCE TO PEOPLE

This coastal zone is important for many human activities, including for fishing, **aquaculture**, the collection of other **marine resources** (e.g. seaweed), recreation and wildlife watching. People also like living near these areas.

FIND OUT MORE

www.thewildclassroom.com/biomes/intertidal.html

BIOLOGICAL marine habitats

As we have seen, physical habitats are defined by their location and the conditions there. Instead, 'biological' habitats are shaped by key species of plants and animals that thrive in a particular place. These key organisms can make a habitat very attractive for other kinds of underwater life. We humans also rely heavily on different biological habitats – though unfortunately our actions can also severely harm them.

KELP FORESTS

CHARACTERISTICS

Kelp forests are found mostly in temperate and polar regions, often near river mouths and sheltered coastlines. Kelp can grow up to 30 cm a day and reach up to 60 m in height!

IMPORTANCE TO PEOPLE

Kelp forests are important habitats for other marine species (e.g. lobster fisheries are often associated with kelp) and influence water flows, encouraging sediment to build up and reducing coastal erosion. Kelp can also be used as a fertilizer, and many cosmetics and pharmaceuticals contain products derived from kelp. Some kinds of kelp can also be eaten.

FIND OUT MORE

http://inchinapinch.com/hab_pgs/marine/kelp/kelp.htm

SEAGRASS BEDS

CHARACTERISTICS

Seagrass beds are found all around the world, often in dense meadows. Seagrasses are the only kind of flowering plant that can exist underwater, and most seagrasses rely on ocean **currents** to distribute their pollen. Unfortunately, seagrass beds are in decline due to human activities such as fishing, disturbance from boats and pollution.

IMPORTANCE TO PEOPLE

Like kelp forests, seagrasses provide important **habitats** for other marine **species**. They also help store carbon, slow down water **currents** at the coast, encourage sediments to accumulate and prevent coastal **erosion**. Many kinds of seagrasses can be eaten. Seagrasses are also used as fertilizers, for mattress fillings and can be woven to make furniture, carpets and rugs.

FIND OUT MORE

www.seagrasswatch.org/seagrass.html

MANGROVES

CHARACTERISTICS

Mangroves are trees that have adapted to having their roots in water most of the time. Their roots are specially adapted to obtain oxygen when the **tide** is high. They get rid of the salt they don't need from **saline** water either through their leaves or by preventing it from entering their roots in the first place. They are found in the **tropics** and sub-tropics along sheltered coastlines such as muddy estuaries, sheltered lagoons, **bays** and inlets. Unfortunately, many mangrove forests have been cleared to make space for urban development, agriculture and **aquaculture** (e.g. shrimp farming).

IMPORTANCE TO PEOPLE

Mangroves provide an important **habitat** to many marine **species**, and are a favoured spot for many breeding fish to raise their **fry**. They also protect the coast against storm damage and encourage sediments and **nutrients** to build up. They act as a source of food, wood, new medicines and dyes. They even help to trap rubbish and other pollutants, which is good for the surrounding water, though bad for the mangroves themselves.

FIND OUT MORE

www.bbc.co.uk/nature/habitats/Mangrove

SALT MARSHES

CHARACTERISTICS

Salt marshes are the mangroves of **temperate** and higher **latitude** areas. Like mangroves, they are found in sheltered coasts, **estuaries** and **deltas**. They consist of herbs, grasses and low shrubs that can live in the intertidal zone. Salt marshes are under threat from clearing for urban development, as well as from **nutrient** and chemical pollution.

IMPORTANCE TO PEOPLE

Salt marshes have many of the same functions as mangroves, such as providing **habitats** for other **species** including **migrating** birds, protecting the coast against **erosion** and storm damage, and encouraging the accumulation of sediments and **nutrients**.

FIND OUT MORE

www.theseashore.org.uk/theseashore/Saltmarsh%20section/Saltmarsh%20introduction.html

CORAL REEFS

CHARACTERISTICS

Coral **reefs** are found all over the planet, from the **tropics** to the polar regions and shallow waters to the deep sea. Corals can be either hard- or soft-bodied. Both types of corals are made up of tiny animals called 'polyps', but in hard corals these polyps produce a shell in which they live. Individual polyps are fixed in one place, connected to the rest of the community by living tissue. Tropical coral **reefs** only make up about 1 percent of the ocean floor, but are home to nearly a quarter of all the life in the ocean!

IMPORTANCE TO PEOPLE

Coral **reefs** provide great **habitats** for other **species**, and protect the coast from storm damage and **erosion**. They are also important for fishing, very popular tourist attractions, and many medicines are being developed from coral reef **species**.

FIND OUT MORE

www.coral.org

BIVALVE BEDS

CHARACTERISTICS

Bivalve beds are structures made up of animals like oysters and mussels. These provide **habitats** for other marine **species**, such as worms and other crustaceans. They are found in the intertidal zone and are one of the most threatened marine **habitats** in the world: **bivalves** are a popular food, so humans have harvested a great deal. Invasive **species**, pollution and disease are also affecting **bivalve** beds.

IMPORTANCE TO PEOPLE

Bivalve beds are an important source of food for marine **species**, as well as for people. **Bivalves** are filter feeders, meaning they feed by taking water inside their shells and removing small particles from it. It has been suggested that they could be used to help clean up water and remove excess **nutrients** from it.

FIND OUT MORE

www.naturalengland.org.uk/ourwork/marine/protectandmanage/mpa/mcz/features/habitats/nativeoysterbeds.aspx

www.naturalengland.org.uk/ourwork/marine/protectandmanage/mpa/mcz/features/habitats/bluemusselbeds.aspx

TAKE CARE: Unless you know the quality of the water where bivalves are found, DO NOT eat them, as they may contain toxins that can make people very ill.

PEOPLE AND THE OCEAN

SEAN PAUL QUIPID, aged 13, PHILIPPINES

Throughout human history, people have had a very close relationship with the ocean. The earliest archaeological evidence of sea voyages comes from the island of Crete. Human tools dating from between 700 000 and 130 000 years ago were found there, which must have been brought by seafaring people as Crete has been separated from the mainland for over 5 million years. By 50 000 years ago, humans were hardy **seafarers**: they had reached Australia, a trip that required crossing hundreds of kilometres of ocean.

Humans rely on the ocean to a huge extent. More and more people are moving to coastal areas and 21 of the world's 33 megacities (cities with a population of more than 10 million) are located in coastal areas. However this is placing increasing demands on coastal resources. Whether we live in cities or the countryside, on the coast or inland, humans are having an impact on the ocean. The next sections describe some of the ways in which people use the ocean and what the impacts of these uses are.

FISHING AND AQUACULTURE

Our ancestors found coasts and the ocean to be a rich source of food and good source of materials for their homes. Archaeological evidence tells us that people have been catching fish and collecting other seafood since about 140 000 years ago. There is evidence of fishing from boats from up to 42 000 years ago. The oldest cooking pots investigated by scientists to date are up to 15 000 years old – and contain traces of cooked fish!

Fishing is the most widespread human activity in the marine environment. About 8 percent of the global population are estimated to work in fisheries and **aquaculture** industries as a whole (*Source*: FAO, 2008). Fisheries can contribute to development, food and nutrition security, and also support many related livelihoods beyond fishing and fish farming.

AH-SANE SCOTT P. A., aged 15, MAURITIUS

DID YOU KNOW?

In 2011, FAO estimated that the global marine fish catch was 78.9 million tonnes. This figure has remained more or less stable since the 1990s, although many individual **species** are becoming threatened.

Eating seafood

We humans are usually at the very top of the **food chain** (though it's always worth watching out for sharks!). Worldwide, more than 2 billion people get most of the protein in their diet from fish and shellfish. Proteins give us energy and are essential for cell growth and repair in the body. Fish are also a good source of vitamins, minerals and amino and fatty acids (e.g. omega-3). Eating fish (particularly oily fish such as mackerel, sardines and anchovies) can help to reduce the risk of heart disease, and is important for brain and eye development.

There are many more kinds of seafood to choose from than just fish and shellfish, however – many people also eat fish **eggs** (known as 'roe'). There are also lots of sea 'vegetables' including different kinds of seaweed, kelp or mosses. Many foods also contain sea products without you even knowing it. For example, 'carrageenins' can be extracted from red seaweeds and are used as a food thickener, especially for meat products (e.g. pâtés) or milk products. Seaweed ice cream anyone?

Depending on where you live, you are likely to eat different types and different amounts of seafood.

Eating seafood isn't always safe, however, as marine creatures can contain contaminants which are poisonous to us (e.g. heavy metals, like mercury). These toxins build up the higher up the **food chain** you eat: while a tiny **phytoplankton** contains tiny amounts

of toxins, bigger predator fish (like tuna or marlin) that have eaten many smaller sea creatures can contain dangerous amounts of contaminants. This is why authorities need to check the quality of the fish that is sold, to make sure it is safe.

Find out more:

www.kidsafeseafood.org

DID YOU KNOW?

On average, a person living in Asia will eat nearly 21 kg of fish per year, more than twice the amount eaten per person in Africa, the continent where fish consumption is lowest.

Fishing gear and practices

ERIKA SVETLANA JARMOLOVSKA, aged 15, LITHUANIA

There are lots of ways to catch seafood! You may have already seen a fishing rod: a pole with a long string attached that has a hook at the end and lets you catch one fish at a time. To catch several fish or shellfish at a time, fishers can leave fishing gear like baskets, pots or nets in a specific place with some food in them to attract underwater creatures. After some hours or days, they then return to collect their catch. At an even bigger scale, fishing gear needs to be towed along behind a boat (e.g. trawl nets), either through the water or along the seabed.

Find out more:

www.fao.org/fishery/geartype/search/en

Fishing takes place at different scales. From smallest to largest:

* **Subsistence fishing:** Subsistence fishers catch just enough to feed themselves and their families, often using traditional methods, like fishing rods or seafood traps.

* **Artisanal fishing and fishing in small teams or cooperatives:** These fishers make a living by supplying their local villages, towns and fish auctions. They may work individually or in groups and usually use more technology that subsistence fishers (e.g. small boats and nets).

* **Industrial fishing:** Industrial fishing can be huge: factory ships can reach 130 m in length and spend many months at sea with each voyage! Many industrial vessels are likely to use advanced electronic equipment that helps to locate fish shoals, and many industrial tuna vessels even carry helicopters to help find and catch fish.

Fishing can have quite a big impact on the environment, which we will explore in Section D.

Aquaculture

As demand for seafood increases, more and more people have started farming fish, shellfish and seaweed. This is known as **aquaculture**. Nearly half of the seafood we now eat comes from such farms, which rear seafood in special pools, tanks, trays or floating cages. **Aquaculture** creates many jobs, and produces useful products besides seafood. Fishmeal, for example, is made from dried fish, their insides and bones. You may think that doesn't sound very nice, but it is very rich in **nutrients**, and is often used on farms as an animal feed or a fertilizer. A lot of pet food contains fish meal, too!

DID YOU KNOW?

Aquaculture imitates the natural cycles and movements of fish in the natural **ecosystem**! For example, salmon farming starts by incubating fertilized **eggs** in specialized hatcheries. The hatched **fry** are then grown in **fresh water** containers or in cages in lakes, until they are ready to move to the marine environment. Rather than swimming there themselves (as they would in the wild), cultivated salmon are transported to the sea in special trucks and continue to grow there in floating cages. They are sold to be eaten after one to two years, weighing around 3 – 5 kg each.

AJIBU TARAWALLIE, aged 12, SIERRA LEONE

Although **aquaculture** can be a good way to avoid **overfishing** the ocean, it can still have negative impacts on the marine environment if it isn't managed properly. For example, **invasive species** may be introduced to an area and water pollution and diseases can spread around a farm when too many fish are kept in a small space. Natural coastal **habitats** may also be lost when **aquaculture** ponds are built: in particular, large areas of mangrove forests have been destroyed to make way for shrimp and milkfish **aquaculture**.

Aquaculture may also still harm wild fish **stocks** because sometimes wild fish (e.g. anchovies) are caught to feed predatory farmed fish (e.g. salmon). **Aquaculture** businesses don't always breed their own fish or shellfish either, but may collect young animals from the ocean and raise them until they can be sold.

It is therefore important that **aquaculture** is well-managed, and in many cases, **aquaculture** is becoming more **sustainable**. For instance:

* Many shrimp farming countries have banned the clearing of mangrove forests for **aquaculture** and in many cases mangrove forests are being recovered around farms.
* Countries farming a lot of milkfish now get the majority of their **fry** from specialized hatcheries, so they rely less on wild fish **stocks**.
* The amount of feed needed to raise a kilogram of fish is often lower than for land animals.

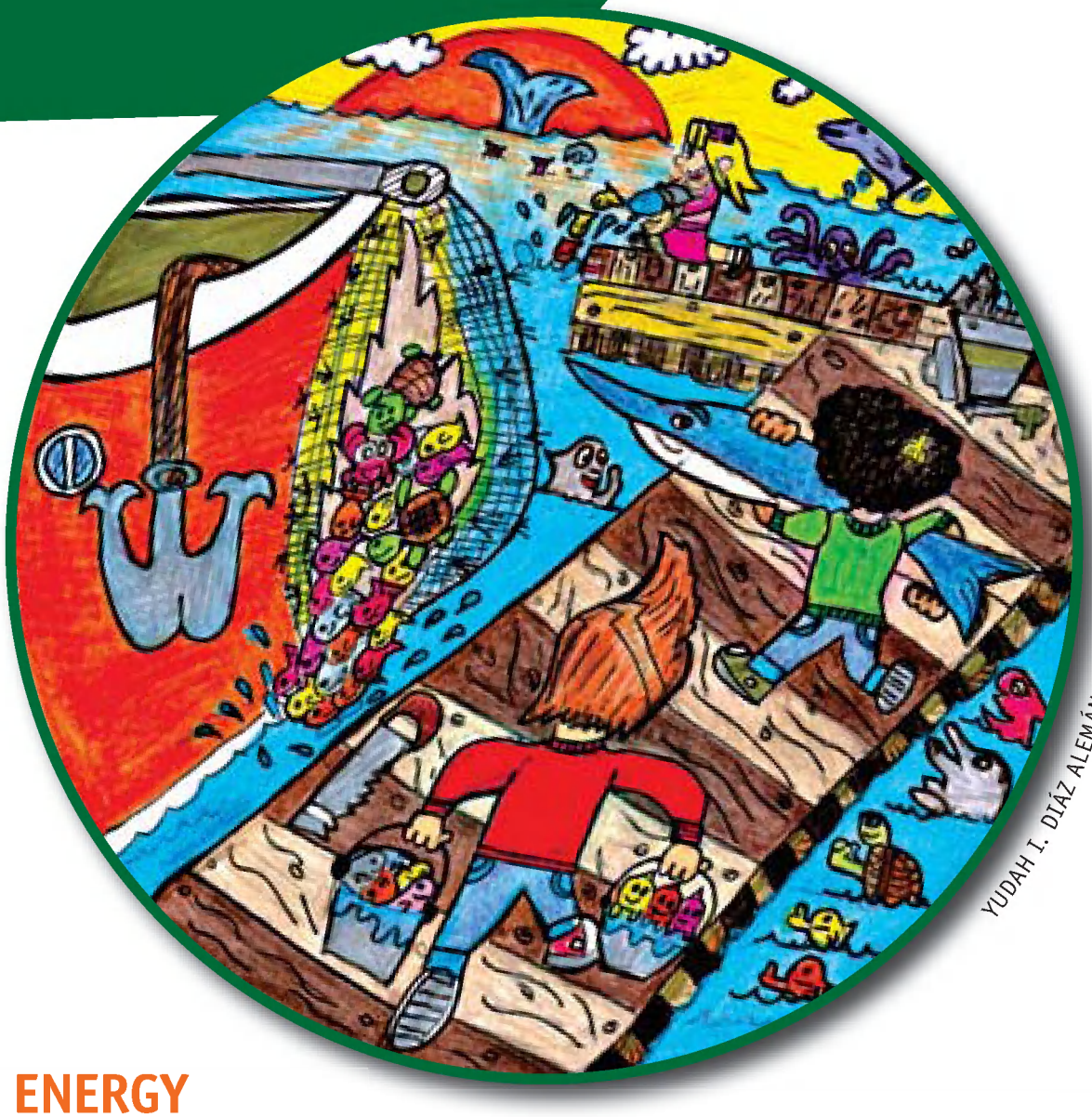
Find out more:

www.fao.org/fishery/aquaculture/en

TRANSPORT AND COMMERCE

Did you know that approximately 90 percent of world trade is carried out by sea? The food you eat and the clothes you wear are likely to have travelled long distances by sea to get to you. There are more than 50 000 merchant ships transporting goods around the world with more than a 1 million **seafarers** working on them.

Transport by sea is usually cheaper and often less environmentally damaging than land or air transport. Nevertheless, maritime transport still emits a great deal of **greenhouse gases** (about 3 percent of global greenhouse gas emissions). Marine transport also runs the risk of accidentally transporting **species** from one place to another, upsetting the balance of local **ecosystems** if these new **species** become **invasive** (find out more in Section D).



YUDAH I. DÍAZ ALEMÁN, aged 12, USA

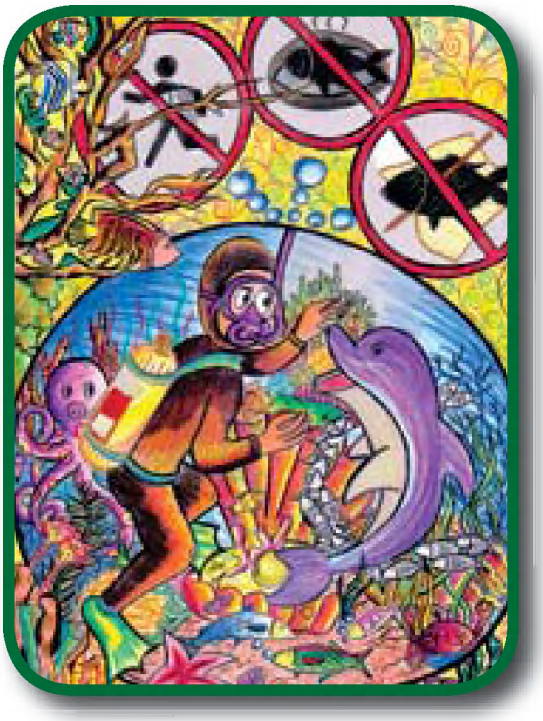
ENERGY

The ocean helps us humans meet our energy needs in several ways. For one, a lot of the oil and the natural gas used in traditional, non-renewable energy systems is found underwater. Offshore drilling for oil or natural gas is very common. However, burning oil and gas to create electricity releases large amounts of **carbon dioxide** into the atmosphere, which, as you know, is a greenhouse gas and contributes to **climate change**.

The ocean also offers us great opportunities to produce **renewable energy**: wind, wave, and tidal power can all be harnessed to generate electricity. The key is that the ocean is constantly in motion and this energy can be used to spin the turbines that produce electricity. **Sustainable** marine energy technologies are still evolving, which is great: the ocean has the potential to provide a significant amount of the world's energy demand.

DID YOU KNOW?

Two of the largest **tidal ranges** in the world are in the Bay of Fundy in Canada (with a difference in water height of up to 16 m), and La Rance **estuary** in France (up to 14 m difference). **Tidal barrages** have been constructed in both places, where the huge amounts of moving water spin turbines to generate electricity.



RAHMATI SERFIYANI CITI, aged 16, INDONESIA

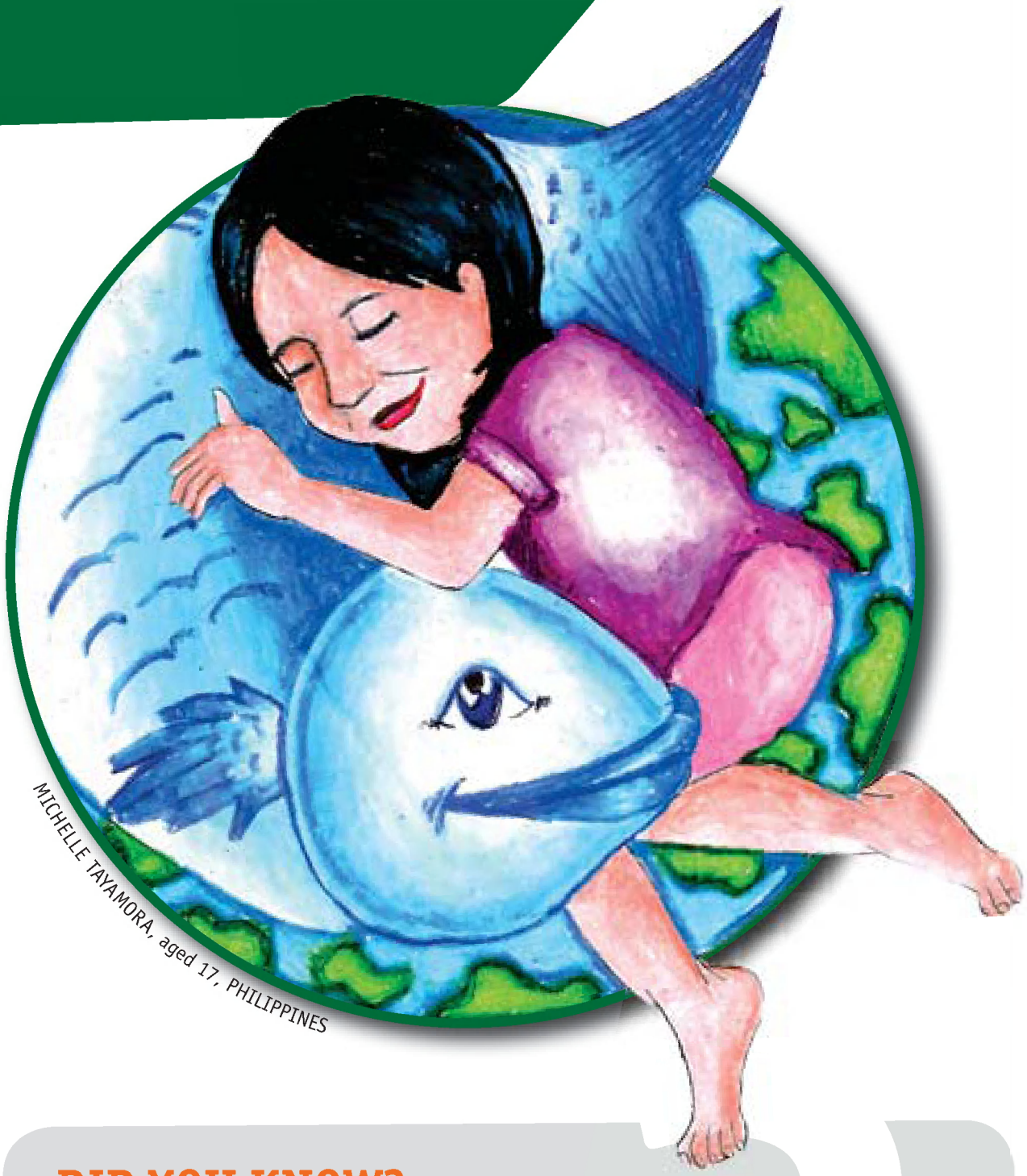
RECREATION AND TOURISM

The ocean is a source of inspiration to many people and offers great opportunities for recreational activities like diving, sailing, surfing or swimming. Marine **ecosystems** like beaches or coral **reefs** often provide important sources of income from recreation and tourism for local populations.

At the same time, recreation and tourism can have quite negative effects on the coastal and marine environment. For example, divers can damage coral **reefs** if they don't take care with their flippers or if they remove pieces of coral; the construction of infrastructure like hotels can lead to more waste and pollution entering the sea; and the widespread use of beaches by holidaymakers can affect the whole **ecosystem** (e.g. turtles can no longer lay their **eggs** in the sand undisturbed). It is therefore important that the recreational use of the **sea** and seaside is well-planned to minimize these impacts.

Find out more:

http://wwf.panda.org/about_our_earth/blue_planet/problems/tourism/tourism_pressure



MICHELLE TAYAMORA, aged 17, PHILIPPINES

DID YOU KNOW?

Does your doctor or dentist have an aquarium in his or her surgery? The presence of fish and water is known to calm patients and reduce anxiety! The positive effects of the marine environment on people's health and wellbeing are increasingly recognized, and initiatives to encourage people to interact more regularly with the marine environment are being developed (e.g. the Blue Gym: **www.bluegym.org.uk**).

DESALINATION

As we learnt in Section A, humans can't drink salt water because it makes us more thirsty, rather than less. To make ocean water drinkable, its salts need to be removed. This process is called **desalination**. Desalinated water can be used in countries that don't have enough **fresh water** for drinking water or to water their crops. So far, countries in the Middle East and North Africa are world leaders in **desalination** technology and generate 60 percent of the world's desalinated water (given their hot and dry **climates**, the extra **fresh water** is very useful).

Unfortunately desalinating water on a large enough scale to provide **fresh water** for everyday human use is expensive, as **desalination** requires special technology and large amounts of energy. **Desalination** can also have a negative impact on ocean **ecosystems** if the by-products of **desalination** are not disposed of responsibly (e.g. if the very salty water left over after the **fresh water** has been extracted is released back into the sea).

NOOMI JHESZHEL D. NAKAMURA, aged 14, PHILIPPINES

MARINE EXPLORATION

To know how to protect and manage the ocean it is important to understand how it works, what lives in it and where (remember, we talked about The Census of Marine Life and the HMS *Challenger* in Section B). We've been exploring the ocean for millennia, but we've still only explored less than 10 percent of it!

DID YOU KNOW?

Mysterious stories about what happens at sea have been told throughout human history. A place that is particularly famous for its strange goings-on is the 'Bermuda Triangle', the area between Bermuda, Puerto Rico and Florida in the Atlantic Ocean. Over 1 000 ships and aeroplanes are supposed to have gone missing there over the past five centuries... With the sea being so big and lots left to explore, who can say?

Find out more:

www.sciencekids.co.nz/sciencefacts/earth/bermudatriangle.html

So let's take a look at some of the things marine scientists have been trying to find out.

The sea from space

Early ocean exploration was undertaken by ship. Today many new methods and technologies are used, such as instruments fixed to satellites orbiting the Earth, which have rapidly increased our knowledge of the ocean. For example:

* the satellite *Aquarius* measures sea surface **salinity**;
* MERIS, an instrument mounted on the European Space Agency Platform, measures ocean colour, which is a good way to estimate how much **phytoplankton** there is in the sea and where.

These instruments send the information they collect back to Earth. The advantage of satellite observations is that huge amounts of data can be collected automatically and over long periods of time.

This data needs to be checked against more detailed measurements made directly from ocean samples, so ocean exploration by sea is still important.

Find out more:

SeaWiFS: http://oceancolor.gsfc.nasa.gov/SeaWiFS/TEACHERS/sanctuary_1.html

Aquarius: http://aquarius.nasa.gov/index.html

POOJA MURALI MURUGAN, aged 6, QATAR

The Catlin Arctic Surveys

To understand **climate change** and its impacts better, the Catlin Arctic Surveys gathered data about the **climate** in the Arctic:

* In 2009, the first survey tried to find out for how much longer the Arctic Ocean's sea ice cover will remain a year-round feature. (Scientists worry that it will start melting in the summer as the Earth's temperatures rise.)

* In 2010, the second survey focused on the effects of **carbon dioxide** on the Arctic Ocean.
* In 2011, the third survey researched how changes in the **seawater** beneath the floating sea ice may be affecting the ocean **currents** that influence **climate** and **weather** patterns around the world.

Find out more:

www.catlinarcticsurvey.com

Similar research programmes take place in the Antarctic too, such as:

www.acecrc.org.au

Commercial exploration

Marine exploration is not only carried out by scientists working for governments, universities or research institutes. Many commercial companies are also exploring the ocean looking for new products that can be used to develop medicines, new forms of **renewable energy**, and, of course, new deposits of oil and gas.

ERICA LUCENA, aged 16, PHILIPPINES

THE OCEAN AT RISK

We humans really do depend on the ocean in a lot of different ways, don't we? We've already been thinking about some of the negative impacts that our actions can have on the marine environment throughout this booklet, because really understanding the problem is a key part of any solution. So before we talk about things we can do to protect marine **ecosystems** and help them recover, let's take a closer look at some of the major threats to the ocean and marine **biodiversity**.

ALIFAH FEBRIANTY, aged 9, INDONESIA

DID YOU KNOW?

Unfortunately, due to threats like **overfishing**, coastal development and tourism, **invasive alien species** or pollution, many marine **species** are under threat from **extinction**, meaning they will soon no longer exist on Earth at all.

The International Union for Conservation of Nature (IUCN) is an international organization which keeps track of endangered **species** in its 'Red List of Threatened Species'. You can browse their Web site by category and find out which marine **species** are vulnerable, endangered or critically endangered: **www.iucnredlist.org.** Not only is **species extinction** a great pity from a nature-lover's perspective, but it also threatens the wellbeing and balance of life on Earth as a whole.

DECREASING FISH STOCKS

The combination of better fishing technologies and our growing demand for seafood means that we are harvesting millions of tonnes of fish each year. The world's population eats almost twice as much fish today as in the 1960s, both because the population is growing and because people are eating more fish. Scientists are very concerned that we are **overfishing** (catching too many fish too fast). The fish can't reproduce quickly enough to keep up, and the **stock** (the number of fish left in the sea) of certain types of popular food fish have already been badly reduced. People especially like to eat large predatory fish, so cod and Bluefin tuna in the North Atlantic, and Bigeye tuna in the Pacific are some examples of **species** that have been severely **overfished**.

DID YOU KNOW?

In 1992, because cod **stocks** had fallen so low, the Canadian government had to forbid fishing for Northern cod (which for the previous 500 years had been an essential part of eastern Canadian livelihoods). Even now, the recovery of the population remains slow. On the other side of the globe, the record price of US$ 1.7 million (!) obtained for one single 222 kg blue fin tuna in Japan in January 2013 shows how scarce the **species** has become.

At the same time, some kinds of fish are caught by accident when fishers actually want to catch another **species**. These unwanted fish are known as **by-catch**, and may be thrown back to sea. However, as they usually don't survive this, the effect on fish populations is the same as if the fish had been caught and used!

Apart from the concern that one day fish **stocks** will collapse completely, declining **stocks** are already becoming a problem for fishers, as boats have to go further and stay at sea longer to bring in the same amount of fish, making it more difficult for fishers to earn a living.

Wider environmental impacts of fishing

Fishing can have wider environmental impacts, too:

* Decreasing numbers of predatory fish mean the **species** they would usually eat are flourishing. For example, the Humboldt Squid population has probably grown so much recently because their predators (including sharks, tuna and billfish) have been **overfished**.

JUAN EDWIN KUSMARTIN, aged 13, INDONESIA

* Certain types of fishing change the structure of the seabed. Fishing gear that is towed along the seabed destroys the **species** and communities that live on top of the seabed as well as those that live within it.

* Unsustainable fishing in one place really affects the whole world, because fish don't respect national boundaries when swimming around!

DID YOU KNOW?

Fishing is not only risky business for fish! It can be quite dangerous for people, too. In fact, fishing is probably the most dangerous occupation in the world. The International Labour Organization (ILO) estimates that 24 000 fishers die in fishing accidents every year...

INVASIVE ALIEN SPECIES

Did you know that ships travelling around the world often pick up unexpected passengers? Sometimes marine **organisms**, like barnacles and mussels, attach themselves to ships' hulls. **Ballast water** is also a problem. To make sure that ships are stable, they may take on **ballast** in the form of **seawater**. This water is held in one or several tanks and is transported from port to port. But as you know, **seawater** contains a myriad of marine life! This means that when the **ballast** is emptied into new environments near the destination port, the marine **organisms** that are also released may become **invasive**. **Invasive alien species** grow and reproduce better than the native **species** in an area, which can upset local **ecosystems** and local **biodiversity** as native **species** are unable to keep up with the competition for food and shelter.

Invasive species include:

* the Mitten Crab which is native to northern Asia and has been introduced to Western Europe, the Baltic Sea and the west coast of North America;
* a fish called the Round Goby which is native to the Black, Asov and Caspian **Seas** and has been introduced to the Baltic Sea and North America; and
* a seaweed called the Asian Kelp which is native to northern Asia and has been introduced to southern Australia, New Zealand, the west coast of the USA, Europe and Argentina.

Find out more:

www.ics-shipping.org

www.imo.org/ourwork/environment/ballastwatermanagement/Pages/Default.aspx

www.imo.org/MediaCentre/Multimedia/Video/Pages/InvadersOfTheSea.aspx

ANGEL HEART T. LECATRIA, aged 9, PHILIPPINES

POLLUTION

Although it's not that nice to think about, the ocean has been used as 'rubbish dump' for our waste for a very long time. Waste may be deliberately dumped at sea, or it may run off from land or through rivers. A lot of the waste that enters the marine environment is **diluted** and spread out, and eventually broken down by physical and biological processes (although this may take centuries, as in the case of plastic). The problem we face now is that the amount of waste we put into the marine environment is so huge, it is causing serious damage. No part of the marine environment is completely untouched.

Plastic

Most of the rubbish found at the coast and floating on the ocean is plastic. Rubbish that doesn't get washed back to land can travel thousands of kilometres on ocean **currents** and may eventually accumulate in the five large systems of circulating ocean **currents**, known as '**gyres**' (see graphic on p.32). The floating rubbish patch in the North Pacific **gyre** is thought to be about twice the size of Hawaii, although media reports suggest it could be as large as continental USA! Apart from being ugly, this rubbish threatens marine life if they eat it or become tangled in it, and it can transport **invasive species** in the same way that ships hulls do.

Find out more:

http://5gyres.org

DID YOU KNOW?

Sunscreen is a great way to protect our skin from burning when it's hot, but unfortunately, many kinds of sunscreen actually damage marine life, especially coral **reefs**. In areas where there are a lot of swimmers wearing sunscreen, all the chemicals that wash off them can kill the underwater plants corals rely on for their growth, ultimately damaging to the whole coral **reef habitat**.

When you're shopping for sunscreen, avoid ones that include paraben, cinnamate, benzophenone or camphor compounds. Instead look for products that are biodegradable or organic, or specifically tell you they are coral safe.

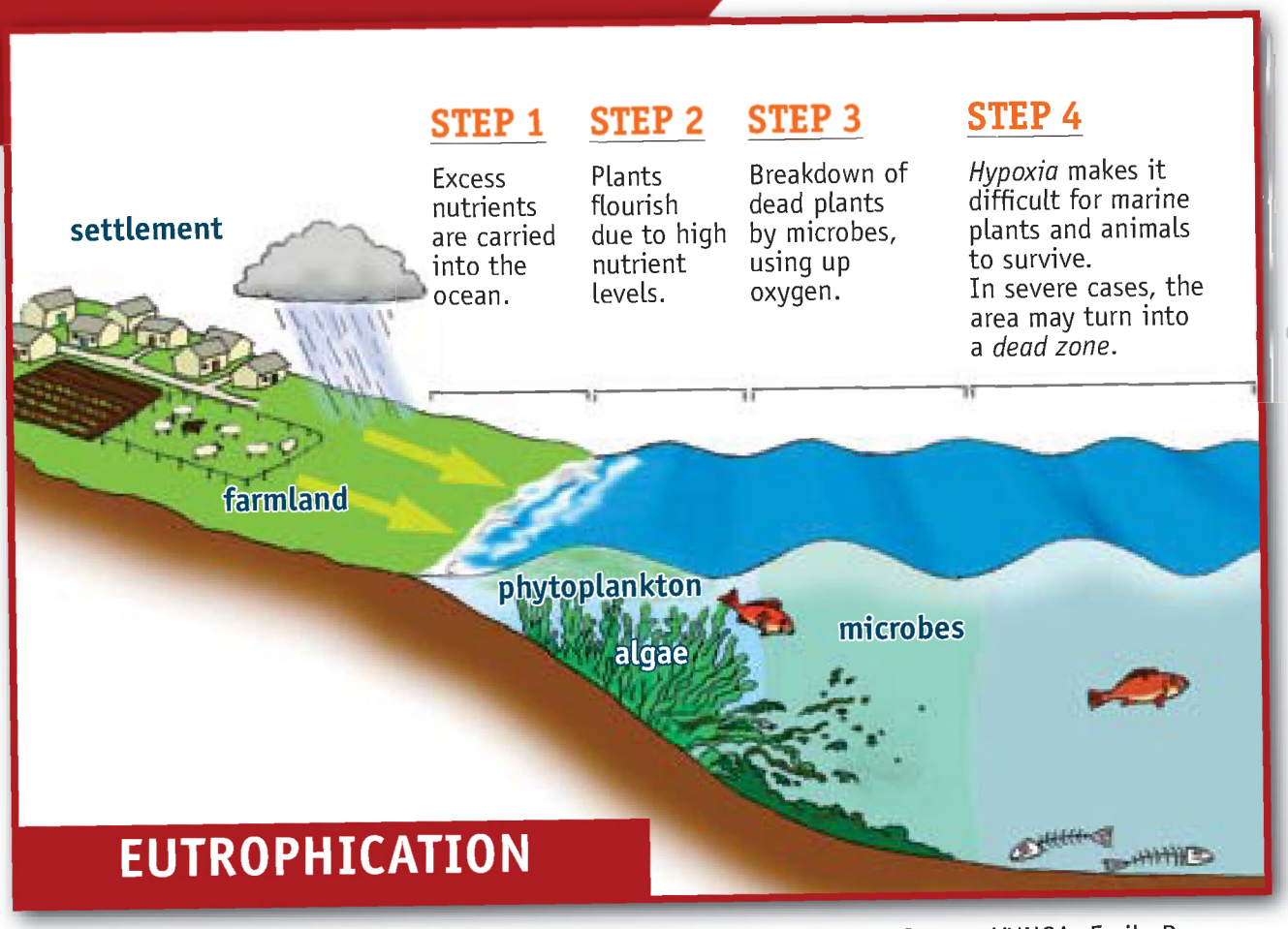
Find out more:

http://sunscreenpollution.blogspot.it

Sewage and run-off

Other forms of pollution include sewage (both human and animal) and the run-off of **nutrients** from agricultural land (see step 1 of the **eutrophication** graphic on p.77). Untreated sewage entering the sea contains bacteria and viruses that can make us ill if we continue using the ocean for recreational activities or eat its seafood.

When too many **nutrients** enter the ocean, something called '**eutrophication**' can happen. The extra **nutrients** cause **phytoplankton** and other algae to grow and reproduce very quickly (see step 2). When they die, they fall to the seabed and are broken down by microbes (step 3). This breakdown uses up the oxygen in the water, resulting in a state known as **hypoxia** (step 4). In extreme cases, whole areas become **dead zones**, because few marine **species** can survive for long without oxygen. In 2011, there were already 530 **dead zones** in the world, and this number keeps growing...



Source: YUNGA, Emily Donegan

A related problem is the rapid growth of **harmful algal blooms** which, in some cases, are fed by the excess **nutrients** from run-off. **Harmful algal blooms** produce toxins that can cause intestinal and breathing problems in people who come into contact with them.

Find out more:

www.wri.org/project/eutrophication

www.cdc.gov/nceh/hsb/hab/default.htm

DID YOU KNOW?

The 'Florida red tide' is a famous example of a **harmful algal bloom**. Florida's coastal waters are monitored all year round to ensure that people act appropriately when the 'red tide' is acting up. For example, they should stop eating shellfish collected from the affected area and avoid swimming in the sea if necessary.

Accidents

Unfortunately, our industrial and energy production systems tend to be rather 'dirty'. For example, more oil enters the ocean each year from industry and transportation than from accidents. Nonetheless, individual accidents can make the situation much worse, with huge impacts on the ocean and the wider environment.

RAVIENA BEDI, aged 19, INDIA

* **Oil spills:** We use oil a lot; to produce electricity, to fuel transport, to make plastics and fibres – the list goes on. Accidents at oil extraction sites (many of which are at sea) or during oil transportation (e.g. by shipping or pipeline) have terrible consequences for all **ecosystems**. Marine life is particularly affected because spilling oil spreads through waters quickly, contaminating them for a long time and killing most of the underwater life in its way. Following the 2010 explosion at the Deepwater Horizon offshore drilling rig in the Gulf of Mexico, up to 585 000 tonnes of crude oil are estimated to have spilled into the sea. Can you imagine how badly that damaged marine **ecosystems**?

* **Nuclear accidents:** Not only oil spills pollute the sea; another example of pollution with scary effects on ocean communities is nuclear radiation. Radiation leaks from nuclear power stations can pollute **groundwater**, **fresh water** and **seawater**, and take a very long time to break down. Even when radiation

pollution isn't high enough to affect people directly, it builds up in underwater **organisms** and damages their **ecosystems**. In 2011, an **earthquake**-triggered **tsunami** hit the east coast of Japan, including the Fukushima Daiichi nuclear power plant. As a result, more radioactive waste was released into the ocean than ever before. Many fisheries in the Fukushima area have had to close, and it is uncertain when it will be safe to eat the fish in the area again.

CLIMATE CHANGE

Globally, our **climate** is changing. **Climate** scientists attribute this **climate change** to increasing **greenhouse gases** in the atmosphere. **Greenhouse gases** include **carbon dioxide**, methane and nitrous oxides. Large volumes of these gases are released by human activities such as burning fossil fuels (coal, oil and gas), for example to produce electricity, for industrial purposes or to fuel transport. Other human activities like cutting down forests also make the situation worse, as there are now fewer trees to **absorb carbon dioxide** (remember: trees are **primary producers** which use **carbon dioxide** to **photosynthesize**).

Have you ever been inside a greenhouse? It gets very warm in there, doesn't it? **Greenhouse gases** act a bit like the transparent glass or plastic in a greenhouse: they let heat from the Sun in, but don't let all of it escape again. Up to a certain point, this is a good thing: without the greenhouse effect, the Earth's average temperature would be around -18 °C. That's too cold for us! Thanks to the greenhouse effect, the average temperature on the planet is around 14 °C.

The problem is, that due to human activity, more and more **greenhouse gases** are present in the atmosphere, making more and more heat build up, and making average temperatures on Earth increase. This also means more of this heat is transferred to the ocean, making the ocean's average temperature increase too.

If **greenhouse gases** keep building up in the atmosphere as they have been doing, here are some of the key ways the ocean is likely to be affected:

Ocean acidification

* The ocean actually **absorbs** gases like **carbon dioxide** from the atmosphere. A natural chemical reaction between **carbon dioxide** and **seawater** dissolves **carbon dioxide** in the ocean. So as **carbon dioxide** builds up in the atmosphere, more and more of it is absorbed by the ocean. Unfortunately, this isn't actually good for the ocean, as too much dissolved **carbon dioxide** makes the ocean become more acidic.

* This acidity can harm marine life, particularly by making it more difficult for underwater creatures (such as corals and shell fish) to build shells and similar hard structures. Biological **habitats** like coral **reefs** and **bivalve** beds are particularly at risk, as they are likely to be seriously damaged, which puts the large **food webs** they support in danger too.

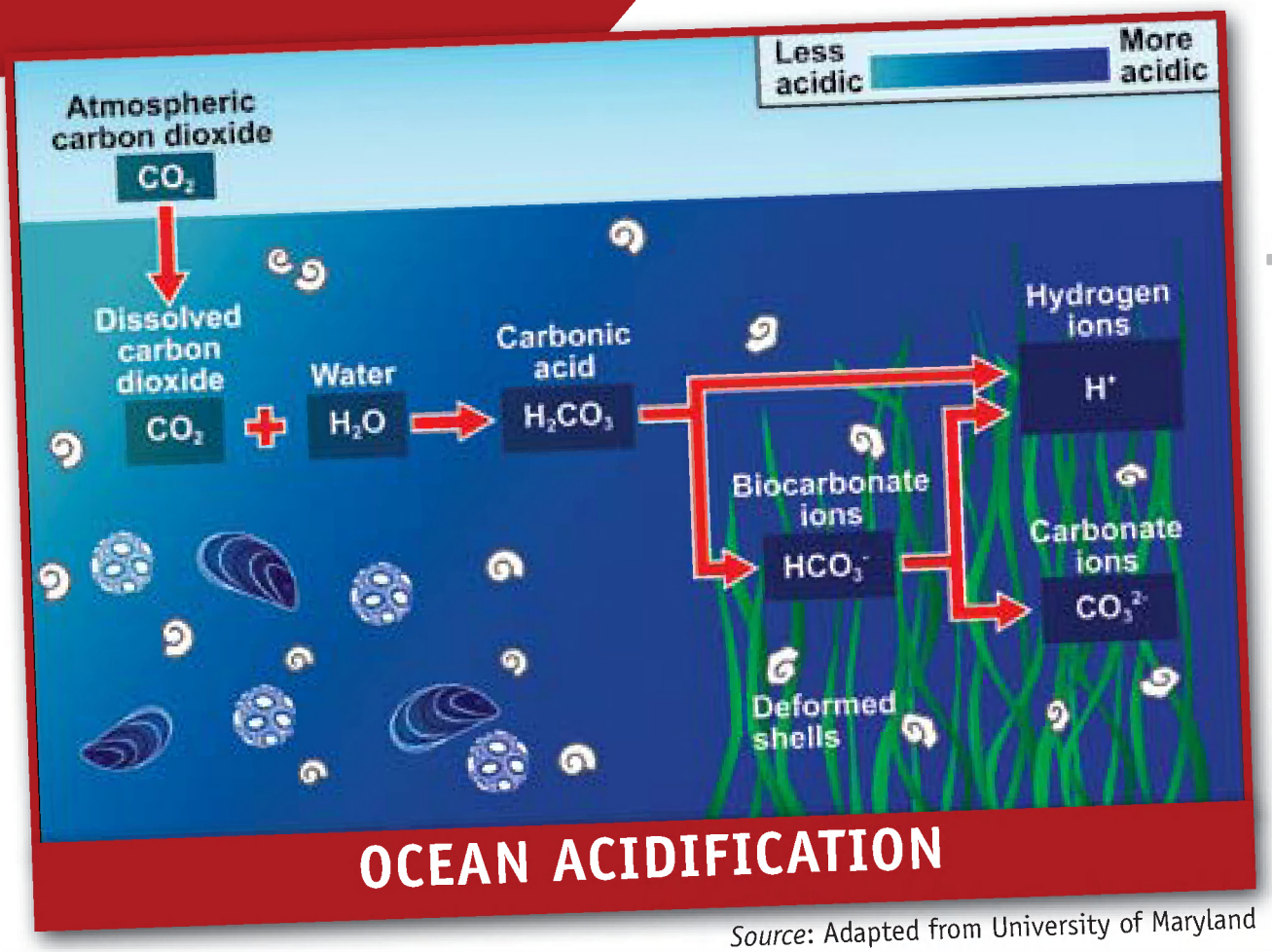
* This knock-on effect isn't only an ecological tragedy, it also threatens to damage human incomes from fishing and tourism.

Increasing extreme weather events

* Extreme **weather** events, like **hurricane**s or **storm surges**, are expected to increase – and get stronger.

* Their impacts will be felt most heavily at the coast.

* This is a real threat to human lives, especially in **developing countries** where disaster preparedness and emergency services aren't as strong as in developed ones.



Source: Adapted from University of Maryland

Rising sea levels

- Warmer ocean temperatures are causing sea levels to rise. This is because warm water takes up more space than cold water, but also because warmer overall temperatures are making glaciers and ice sheets melt, meaning there is more water flowing into the ocean.
- Rising sea levels increase the danger of flooding, especially in low areas near the coast.
- Some low islands are at risk of being covered by the ocean completely (e.g. the Maldives and the Seychelles).
- Farmland near the coast is likely to suffer as salt water enters the soil – like humans, most plants need **fresh water** to live, and can't grow in salty ground.
- Coastal **erosion** will increase, threatening coastal **habitats** and life.

DID YOU KNOW?

In 2009, the president of the Maldives and his cabinet signed a document calling for global cuts in **greenhouse gas** emissions – UNDERWATER! They were making the point that, if **greenhouse gas** emissions keep increasing, the Maldives would soon be covered by the ocean and all their meetings would have to take place at the bottom of the sea... Here's a short video about the meeting: **www.youtube.com/watch?v=odFmDiYWJOM**

Melting sea ice

* In 10 or 20 years, the permanent Arctic ice cap is likely to melt in summer as a result of climate change. This would particularly affect people and animals in the Arctic who rely on the sea ice as a hunting platform (**see http://wagggsworld.org/en/grab/23595/1/wildlife-factfile-v5.pdf**).
* But it would also affect the whole world: the huge icy white surface reflects some of the Sun's heat back to space, helping to keep our planet from getting too hot (this is called the 'Albedo Effect').

Changing ocean currents

* The ocean's **salinity** levels are changing due to **climate change**, with polar regions becoming warmer and less salty and the **tropics** becoming warmer and more salty.
* As you now know, water temperatures and water **densities** drive ocean **currents**. As sea temperatures rise and **salinity** levels change, the ocean **currents** we are familiar with and rely on are likely to change too. This will disturb the wider **climate** (e.g. if the **Gulf Stream** stops carrying warm water, it will get a lot colder in the UK).

* Furthermore, currents that already change direction periodically will change more frequently (e.g. the El Niño Southern Oscillation: **http://education.nationalgeographic.com/education/encyclopedia/el-nino/?ar_a=1**).

* These changes to weather and climate will affect where species can live both on land and in the ocean.

Climate change and marine migration

* As the ocean's waters warm, species at the bottom of the food chain like phytoplankton will drift towards the poles in order to breed and survive.

* Species that eat them are forced to follow, causing mass movement in marine populations.

* Species that can't follow quickly enough will have to change their diet. If they don't manage, they are likely to become extinct, at least in certain parts of the world.

* Of course, all this change has an impact on fishers too: they need to travel further to catch their preferred species, or need to target new species.

Find out more:

http://climatekids.nasa.gov/big-questions/#/ocean

www.sciencenewsforkids.org/2011/04/sea-changes

DID YOU KNOW?

WAGGGS has been working with Greenpeace to raise awareness of the dangers of overfishing, oil drilling and conflict in the Arctic Ocean. Find out more about this at: **www.wagggs.org/en/flagforthefuture/SavetheArctic**

TAKE ACTION

JOSEPH JASKAMARA, aged 20, SIERRA LEONE

We've seen the many ways in which our dependence on the ocean can affect and damage it. So who is responsible for protecting the ocean? That's a very good question. The answer is all of us! But of course people have different levels of influence and abilities, so there are different things each of us can do to help.

ACTIONS FOR GOVERNMENTS, DECISION-MAKERS, FISHERS AND FISH FARMERS

Taking responsibility for the ocean can be a little tricky, as national boundaries are harder to define at sea than on land. Unfortunately, people are usually less likely to take good care of common areas than areas that they alone are responsible for, because they worry that everyone else will try to get as much as possible out of the shared resources too. This overuse of resources is often called 'the tragedy of the commons'. Let's find out more about the different agreements, regulations, organizations and types of community-based management systems that are trying to prevent such a tragedy from befalling our ocean.

International agreements

Since 1994, a treaty called the United Nations Convention on the Law of the Sea (UNCLOS) has been in force. The Convention defines two key areas:

* **Territorial seas** extend 12 nautical miles (22.2 km) from the coast of a country and are considered to be part of that country, governed by that country's laws.

* **Exclusive economic zones** extend 200 nautical miles (370 km) from a country's coast and give that country rights to the resources on the seabed.

JAMIA MEI TOLENTINO, aged 14, PHILIPPINES

In addition to defining the rights of individual countries, UNCLOS obliges all countries to protect the ocean. This requires good cooperation between countries. The ocean is so huge, however, that large parts of it exist outside exclusive economic zones. A number of other international organizations and agreements exist to protect the marine environment from the risks discussed in Section D and encourage international collaboration. They include:

* **Regional Fisheries Management Organizations**, which set regulations for fisheries management beyond individual countries' exclusive economic zones.
* The **International Monitoring Control and Surveillance Network (IMCS)** also aims to fight illegal and unregulated fishing, by improving cooperation between national organizations responsible for fisheries.
* The new **Global Ocean Commission** aims to produce achievable regulations on fishing, **biodiversity** and **habitat** loss and improve the management of the ocean.
* The **International Seabed Authority** is responsible for organizing and controlling mineral related activities to prevent damages to the seabed.
* The **International Maritime Organization** is responsible for the safety and security of shipping and the prevention of pollution by ships. It is also responsible for initiatives like GloBallast, which aim to reduce the spread of **invasive species**.
* The **Ramsar Convention** aims to protect wetlands including salt marshes, mangroves, seagrass beds, coral **reefs** and other shallow marine areas.
* The **Convention on Biological Diversity** aims to conserve global **biodiversity**, including marine **biodiversity**.

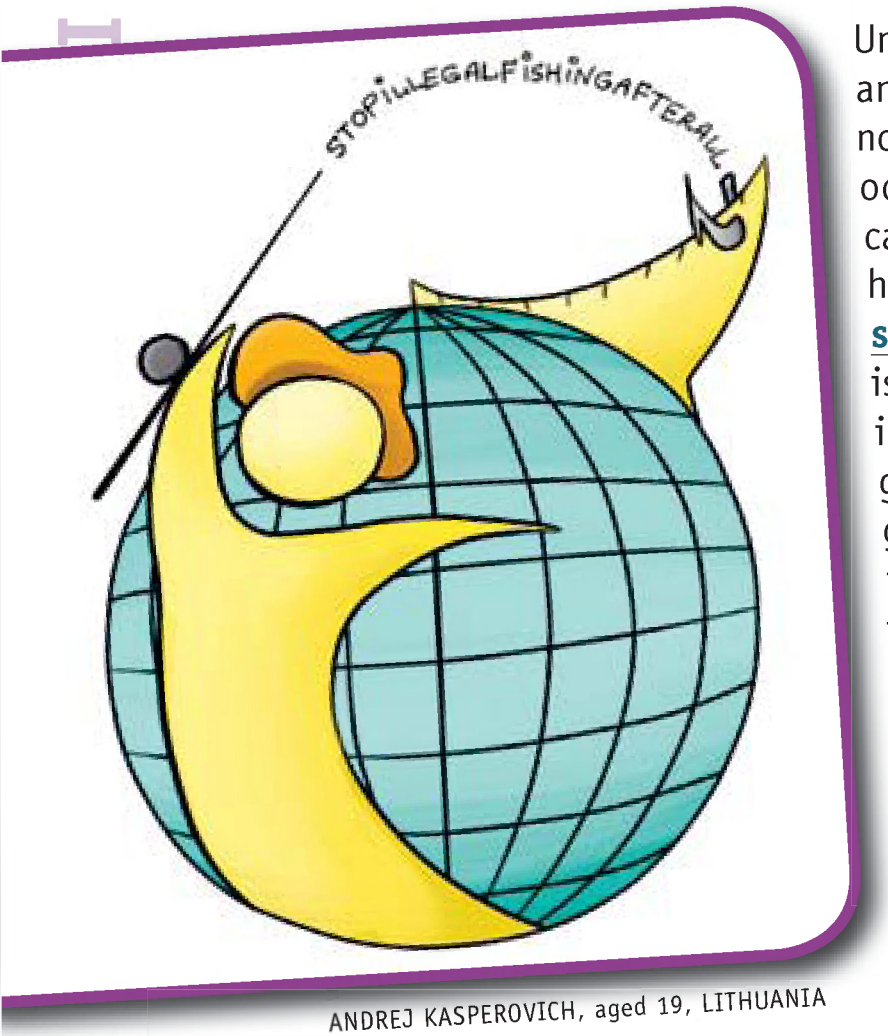
ANGELICA MAY CHEGYEM, aged 17, PHILIPPINES

- The **Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)** aims to ensure that populations of endangered plants and animals aren't bought and sold in ways that would threaten their survival.
- The **Intergovernmental Oceanographic Commission (IOC) of the United Nations Educational, Scientific and Cultural Organization (UNESCO)** is the United Nations body for ocean science and providing ocean services, such as **tsunami** warning systems.
- The **United Nations Framework Convention on Climate Change (UNFCCC)** is working to get national governments to commit to cutting down national greenhouse gas emissions to help prevent the negative impacts **climate change** is expected to have on the Earth's land and ocean **ecosystems**.

Managing fisheries sustainably

As we have seen, we will lose the valuable food source seafood provides if we keep **overfishing**. National governments or groups of countries have introduced a number of measures to try to reduce **overfishing**, such as:

* **Quotas** limiting the amount of fish that are allowed to be caught.
* Reducing or banning the use of equipment or techniques that cause particular environmental damage (e.g. many countries have banned trawling the seabed with huge trawl nets).
* Limiting the number of days that fishers can spend at **sea**.
* Closing certain areas of the ocean to fishing or particular types of fishing.



ANDREJ KASPEROVICH, aged 19, LITHUANIA

Unlike farmers, who can own and fence off fields, fishers do not usually own the areas of ocean in which they work, and cannot stop other fishers from helping themselves to seafood **stocks** too. This open access is one of the major problems in managing fisheries. Some governments have started giving leases to fishers or fishing communities so that, like farmers, they have exclusive use of a particular area.

DID YOU KNOW?

In Chile, abalone (a type of shellfish) was being **overfished** because it was so valuable. Measures such as enforcing **quotas** were not helping abalone **stocks** to recover. The government then decided to grant groups of fishers exclusive rights to fish in a particular area. Research shows that fishers caught more and larger abalone in the areas they controlled themselves than fishers did in neighbouring open access areas.

Community-based fisheries and cooperatives

As we have seen, working as a group within a community (also known as a 'cooperative') can be a good way for fishers and fish farmers to achieve common goals. Some cooperatives buy shared equipment, such as for catching, smoking or drying fish. This enables them to produce more fish than individuals could produce on their own. Cooperatives also work together to make sure that all their members are fishing **sustainably**, which is in everyone's long-term interest. For example, a cooperative might set up rules that say fishers should take turns going out to **sea** to help prevent **overfishing**. Having large groups of fishers and fish farmers following such rules is obviously much better than if a few try to fish **sustainably** while others may not!

Cooperatives also tend to have more power at a political level than individual fishers, because a representative of the cooperative can speak for many, rather than just for him or herself. This makes government authorities more likely to listen to the needs of a cooperative. Agreeing on what collective action to take may not always be easy (individuals tend to have different ideas!), but the extra effort makes community-based fisheries a fair, effective and **sustainable** way of managing **marine resources** collectively.

Ecolabelling and certification schemes

Another way to help make fisheries and **aquaculture** more **sustainable** is to involve the people who buy and eat seafood through **ecolabelling** or **aquaculture certification schemes**. Ecolabels are symbols placed on the packaging of seafood. These labels tell the buyer that the seafood meets an agreed environmental standard under an appropriate **certification scheme**. Buyers can then choose to buy that fish rather than one caught or farmed less **sustainably**. **Ecolabelled** food can be sold for a higher price, so fishers and fish farmers can earn extra money if they fish or farm **sustainably**. However, the requirements for being awarded an **ecolabel** must be solid and well-enforced to make sure the labelled seafood is really **sustainable**.

Find out more:

- The **Marine Stewardship Council** is one example of an ecolabelling scheme: **www.msc.org**
- The **World Wildlife Fund** also works with the MSC on sustainable fishing: **http://wwf.panda.org/what_we_do/how_we_work/conservation/marine/sustainable_fishing**
- **FAO** has developed guidelines for ecolabelling fish and fish products: **www.fao.org/fishery/topic/13293/en**

Marine Protected Areas

Another way of protecting the ocean at an international level is by creating **marine protected areas**. **Marine protected areas** work in a similar way to national parks on land, where activities are controlled to make sure that as little harm as possible is done to marine life within the protected area.

A difficulty with this idea is that the areas that need protection most need it because they are heavily used by people. Turning them into **marine protected areas** may mean that these people can't work in some or all parts of the protected area anymore.

Consequently, fishers or traders are quite likely to worry that **marine protected areas** will threaten their livelihoods. It is therefore important to involve ocean users in the planning and management of such areas, and to discuss with them how allowing the area to recover could be good for fisheries and the marine environment in the long term. For example, adult fish, **eggs** and **larvae** will move from the protected area out into the areas of ocean where fishing is still allowed, supplying fisheries in the long term. Examples of successful **marine protected areas** around the world include the Philippines, Kenya, the Caribbean, Chile, Belize, Rhode Island, Venezuela, France and New Zealand.

LORD AHZRIN D. BACALLA, aged 12, PHILIPPINES

ACTIONS FOR YOU!

Protecting the marine environment isn't just about the many international agreements and national policies we've just learned about: in the end, it all comes down to the things each and every one of us do. So what are you waiting for? Take the challenge and help protect the ocean. Are you ready? Here are 10 ideas to start you off:

EAT SEAFOOD SUSTAINABLY

You can help stop the rapid depletion of global fish populations one meal at a time. Convince your friends and family to eat fish **species** that are more abundant, such as mackerel or herring, rather than those that are at risk of being overfished, like cod or tuna. To avoid wasting food, try not to buy more fish than you need and pay attention to expiry dates. If your family catches its own fish, try to avoid vulnerable **species**. You can also try to buy fish which you know has been caught or farmed **sustainably**, such as **ecolabelled** or **certified** fish.

BUY OCEAN-FRIENDLY PRODUCTS

Avoid purchasing items such tortoiseshell or shark leather accessories. Also take the time to check the labels of items such as cleaning products, fertilizers for your garden, sunscreens and even some medicines. They can be damaging to the environment, especially if they get into water systems. Always try not to be wasteful when you use the products you buy: using just the amount you need is good for the environment!

SHRINK YOUR CARBON FOOTPRINT

Your 'carbon footprint' is the amount of **carbon dioxide** your everyday activities release into the atmosphere, contributing to **climate change**. The more **carbon dioxide** and other **greenhouse gases** your activities create, the bigger your footprint. Think of all the things you do that produce **greenhouse gas** emissions (e.g. when you use electricity or energy, travel somewhere in a motorized vehicle, or buy products that took a lot of **carbon dioxide** to make or get to you, like fruit flown in from far away). Then think of all the things you can do to make your footprint smaller (like turning off the lights or heating when you don't really need them, using public transport instead of a private motorbike or car, or buying locally grown fruit and vegetables that are in season).

REDUCE YOUR USE OF PLASTIC

Discarded plastics severely damage marine **habitats** and kill large numbers of marine animals each year. Find as many ways to avoid using plastic as you can: switch to a reusable water bottle, use a cloth bag for shopping, etc...

CLEAN UP YOUR LOCAL BEACH

Dirty and littered beaches aren't only ugly, animals and plants living there will also be less healthy. Participate in or organize a beach clean-up to help set things straight!

CHOOSE OCEAN-FRIENDLY RECREATIONAL ACTIVITIES

Unfortunately, not all water activities are really good for the ocean. Which ones do you think might be harmful, and why? If you are having a nice day by the sea, pick fun activities that don't damage the environment.

BE RESPONSIBLE WITH YOUR AQUARIUM

If you have an aquarium, avoid stocking it with wild-caught saltwater fish (as you'd be removing them from their natural **ecosystem**). In the same way, never release any aquarium fish into the ocean, as you could be introducing non-native **species** or even diseases into the natural environment.

VOLUNTEER WITH A MARINE CONSERVATION ORGANIZATION

There are lots of ways we can help protect the marine environment as a part of a group. Find out about the marine conservation organizations in your area and get involved!

SPREAD THE WORD

The more we learn about the ocean, the more we are likely to want to take care of it. Use the facts you have discovered doing this challenge badge to motivate your friends, family and local community to join in the effort to protect the world's ocean. Why not talk to fishers and fish farmers in your area about topics that particularly interest you? They will have valuable first-hand experiences to share with you.

GET POLITICAL

You can contact your local representatives to let them know you support marine management and conservation projects. If you (or members of your family) are about to vote in an election, how about finding out which politicians support ocean-friendly policies first?

You'll find many more ideas in the activities in Section E of this badge – so GET INVOLVED and TAKE ACTION!

SECTION A:

OCEAN IN MOTION

DO EITHER A.1. OR A.2. AND (AT LEAST) ONE OTHER ACTIVITY OF YOUR CHOICE.

AFTER COMPLETING OUR OCEAN IN MOTION ACTIVITIES, YOU WILL BE able TO:

* **RECOGNIZE** the movements of the ocean, including waves, tides, and currents.
* **UNDERSTAND** the ocean's influence on local weather and global climate systems.

DO ONE OF THE TWO COMPULSORY ACTIVITIES BELOW:

A.01 OUR OCEAN

LEVEL 3 2 1

Materials: *Internet access or access to reference books.*

In pairs or on your own, find out some key facts about the ocean (or sea) closest to where you live. For example, how big and deep is it? What human activities go on there? In what other ways does this ocean or sea influence your lives? Put together a quiz for the rest of your group and compare your findings by answering each other's questions.

A.02 SEAWATER EXPERIMENTS

LEVEL 3 2 1

Materials: *Large clear plastic beakers or containers (at least 1 litre in size, an empty bottle will do), measuring jugs, scales, salt, food colouring, tap water, some seawater (if possible), some ice cubes.*

Upper estuary:	Dissolve ½ teaspoon of salt in 250 ml of warm water
Lower estuary:	Dissolve 1 teaspoon of salt in 250 ml of warm water
Open ocean:	Dissolve 1½ teaspoons of salt in 250 ml of warm water
Rock pool:	Dissolve 2½ teaspoons of salt in 250 ml of warm water
Dead sea:	Dissolve 13 teaspoons in 250 ml of warm water

Some activities in this section require participants to go near beaches, the ocean or other water bodies. Be sure to take safety precautions and ensure that suitable supervision is at hand.

SALINITY AND DENSITY

Salt makes seawater more dense (heavier) than fresh water. Take 500 ml of fresh water and 500 ml of seawater (real or home-made!) and add some food colouring to either one of them (remember which one you added it to). Pour the fresh water into the large clear plastic container. Then, carefully and slowly, pour the seawater into the same container. What happens? Why do you think this is? What do you think happens when rainwater falls on the ocean?

TEMPERATURE AND DENSITY

You can also try this with hot water and cold water (have an adult help you with the hot water). Which is denser? Draw a picture of your experiment and write a short description of what you did, what happened and why you think this was.

MEETING WATERS

Now you can experiment in many different ways with different kinds of water in different conditions. For example, take some ice cubes and melt them in the recipe for 'open ocean'. What does this represent in the real ocean? Simulate rain falling or a river flowing into your ocean water and repeat the experiment. Also discuss why the water is saltier in some places than others. Can you find the Dead Sea on a map? Why is it so salty? Which is the least salty sea in the world and why do you think that is?

SALT CYCLE

Finally, how about you take the recipe for 'open ocean' and leave it out in the sun or in a warm place for a couple of hours. What happens and why? Draw a sketch of the water cycle. Include elements like lakes, rivers, coastal waters, the open ocean and rain – go into as much detail as you can! Colour-code the water in different places according to its salinity, also showing where mixing takes place.

CHOOSE (AT LEAST) ONE ADDITIONAL ACTIVITY FROM THE LIST BELOW:

A.03 MAKING WAVES

LEVEL 1

Materials: *A large, shallow tray or pan (at least 10 cm deep), water, a paper fan.*

Discuss with your leader what you already know about waves. What are they? How do you think they are formed? How do people use waves? How do waves affect the coastline?
Fill the tray/pan with about 7-10 cm of water. Get one person to wave the fan up and down, from about 30 cm away from the tray/pan. What do you see? What do you think will happen if the fanning gets faster? Try it out and see.

A.04 MAKE A CLOUD

LEVEL 1

Materials: *A 2 litre clear plastic bottle, matches and warm water.*
Particular caution and adult supervision required.

1. Pour warm water into the bottle until it is about one third full, then close the lid. This warm water will start **evaporating** (especially if you place the bottle in the Sun). This will add water **vapour** to the air in the bottle, the first ingredient for making clouds.
2. Squeeze the bottle and then release it. The squeeze represents the atmosphere warming up, and the release represents it cooling down. If water droplets appear on the sides of the bottle (this is called **condensation**), shake it to get rid of them.
3. Take the lid off the bottle. Carefully light a match and hold it near the bottle's opening for a few seconds. Then drop the match into the bottle and quickly put the lid back on, trapping any smoke inside. Smoke is made up of many small particles, like dust. These particles are the second ingredient for making clouds.
4. Once again, slowly squeeze the bottle hard – and then release. What happens this time? You should see a cloud form inside the bottle when you squeeze it, but when you release it, the cloud disappears!

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A.05 MAKING FOG

LEVEL 1

Materials: *A glass jar, a sieve or strainer, water and ice cubes.*

Carefully fill up the glass jar with hot water. Then carefully pour most of the water out again, only leaving about 3 cm of water in the bottom of the jar. Put the sieve or strainer over the top of the jar and place a few ice cubes (three or four) into it. What happens? The cold air from the ice cubes meets the warm, moist air in the jar, making the water **condense** and form an eerie fog...

A.06 EXTRACTING SALT

LEVEL 2 1

Materials: *A shallow dish with sides (e.g. a baking tray),* **seawater** *(or a solution of 1½ teaspoons of salt in 250 ml warm water), a protected outside area or a sunny windowsill, scales.*

Pour 1-2 cm of **seawater** into the dish and leave it in the Sun. Slowly, the water will **evaporate** (disappear into the atmosphere), leaving only the salt behind. Everybody guess how long you think it will take for the water to disappear. Once the water has gone, the person who guessed closest can taste the crystals left in the tray, to make sure they are really salt. Collect the salt and weigh it. How much water would you need to get 100 g of salt?

Extension: On your own, find out some interesting facts about salt. For example, what is salt? Why is salt important for humans? Why shouldn't we drink salty water? How much salt is in **seawater** and has **seawater** always been this salty? When you buy sea-salt from the shops, how is it extracted from the **sea**? What do we use salt for? Make up a poster of key salt facts.

To get you started, visit:
www.marinebio.net/marinescience/02ocean/swcomposition.htm

GOOD IDEA

A.07 EXTRACTING FRESH WATER

LEVEL 2 1

Materials: A large metal pan, a cup, a clean piece of clear plastic or plastic food wrap, sticky tape, small stones or other weights, **seawater** (or a solution of 1½ teaspoons of salt in 250 ml warm water).

1. Place the cup in the middle of the pan.
2. Pour **seawater** into the pan (but not the cup) until it is about 4 cm deep. If the cup starts to float, put a clean weight into it.
3. Cover the top of the pan with the clear plastic or plastic food wrap. Attach the plastic to the pan with the sticky tape making sure it is securely fastened so nothing can get into the pan. Put a weight on to the plastic so that the plastic sags over the cup but doesn't touch it.
4. Leave your pan in a warm or sunny place.
5. Over time, the heat from the Sun will make the water **evaporate**, but as the **evaporated** water touches the plastic, it will form drops that will run down the plastic and collect in the cup. When enough water has collected, ask a volunteer to taste it. Is it really **fresh water**?

Extension: Individually or in pairs, research other ways in which **fresh water** can be extracted from saltwater. Design an experiment or presentation for your group to show how it could be done if you had the right equipment.

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A.08 BUILDING AN UNDERWATER SCOPE

LEVEL ● 2 1

Materials: *A large plastic tub (e.g. a yoghurt pot), clear plastic food wrap, elastic bands or sticky tape.*

To build an underwater scope, cut off the end of the plastic tub so that it becomes a tube. Cover the end with clear plastic food wrap and make sure it is securely attached to the tube using elastic bands or sticky tape. The next time you go to the beach, find a sheltered, shallow and calm part of the **sea** (a rock pool would be ideal) and have a look at what is going on underwater. Put the end of the tube with the plastic on into the water. The water should push the clear plastic up slightly, making it act as a lens and magnifying what you see! Write down what you see and/or draw pictures.

A.09 BUILDING A HYDROPHONE

LEVEL ● 2 1

Materials: *A small microphone that can be attached directly to some earphones, a balloon, a small piece of rubber tubing, non-hardening clay or putty, a cable tie, some water-based lubricant, some small coins.*

To listen to underwater sounds, build a hydrophone (an underwater microphone).

1. Put a small microphone inside the balloon (the thicker the balloon, the better). Water-based lubricant (like a soap solution) can help you slip the microphone inside, but be careful not to get it too wet.
2. Also put some small coins in the balloon to make sure that it will sink when you put it in water.
3. Connect the microphone to the headphones.
4. Make a plug for the neck of the balloon using a piece of thick rubber tubing. Run the microphone/headphone cord through the tube and fill it with non-hardening clay or putty.
5. Make sure there is a tight seal around the neck of the balloon using the cable tie.
6. The next time you go to the beach, try it out. What can you hear?

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A.10 OCEAN LOCATION

LEVEL 3 2 1

Materials: *A map or globe of the Earth. Maps to label can be printed from:* ***www.enchantedlearning.com/language/english/label/oceans.***

Have a look at a map or globe of the Earth. What is the main colour you see on it? Why? Can you name the five main oceans? And how many names of different **seas** can you spot? Which is the closest **sea** to where you live and which is the closest ocean? If possible, go and visit them. What other features does your map or globe name in the ocean? Draw your own map of the world's ocean and label as many individual oceans and **seas** as you can.

A.11 HURRICANES, CYCLONES, TYPHOONS

LEVEL 3 2

Materials: *Information on* **hurricanes**, *e.g. from* ***www.WeatherWizKids.com.***

Read up on **hurricanes** (also known as **cyclones** and **typhoons**). Split into groups and put together a multiple choice quiz about them to test the knowledge of the other groups. Before announcing the winner, let everybody know the correct answers.

Extension: Find out about a **hurricane**, **cyclone** or **typhoon** and write a newspaper article about it. When did it occur and how strong were the winds? What preparations were made by the communities living along the coast it affected? What damage did it cause? Could anything have been done to prevent the damage? If you live in an area where **hurricanes** occur, do you know what to do when they happen? Make an action plan to help keep yourself and your family safe.

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A.12 TSUNAMI BROADCAST

LEVEL 3 2

Materials: *Internet access, article from National Geographic News about the* **tsunami** *in Samoa and American Samoa (2009):* ***http://news.nationalgeographic.com/news/2009/09/090929-tsunami-warning-samoa-earthquake.html****. Access to people who have experienced a tsunami, a recording device (e.g. Dictaphone).*

Read the article on the Samoa **earthquake** and, in small groups, put together a radio broadcast about **tsunamis** and tips on surviving them. One of you could be the interviewer and another could pretend to be a **tsunami** expert being interviewed. If you know someone who has lived through a **tsunami**, ask them if they would be happy to share their experiences with you. If not, get another member of your group to imagine what it might be like to have seen a **tsunami**. You might want to write a script before you start recording. If you don't have access to a Dictaphone or other recording device, act out your script in front of the rest of your group. If you live near the coast, find out whether you are at risk from **tsunamis**. If you are, find out how to spot the warning signs and create an action plan for staying safe. Share this with your family and friends.

Extension: Find out more about the impact of the Asian **tsunami** in 2004. Why was the effect of the Asian **tsunami** worse in some areas than others? How did the plant life at the coast influence the effect of the **tsunami**? Write an article for a fictional newspaper about the impact of the Asian **tsunami** in a particular area.

A.13 OCEAN CURRENTS

LEVEL 3 2

Materials: *Internet access, a map of deep water ocean currents. This clip about currents may also help:* ***www.montereyinstitute.org/noaa/lesson08.html.***

Note: this activity requires an understanding of gravity and how salinity and temperature affect the density of seawater. If you are unfamiliar with this, you may want to carry out activity A.2. first.

How many different types of **current** can you think of? What are the two most important types of **current**? What is a **gyre**? Using your knowledge of how the **salinity** and water temperature affect the **density** of **seawater**, explain how deep water **currents** work and how water circulates around the ocean. Why do you think ocean **currents** are important? Individually or in pairs, write down ten facts about **currents**. Put these on the wall of your meeting room as part of an ocean display.

Extension: Some **currents** don't always flow in the same direction and are known to vary ('oscillate') between different directions. One such example is the El Niño Southern Oscillation. Find out what you can about the El Niño Southern Oscillation and write a short technical article about how it works and what this oscillation means for marine life and fishers in the area. What happens in other areas of the world in an El Niño year (e.g. in Australia and Africa)? How has the El Niño Southern Oscillation been changing in recent decades? What is considered responsible for this change?

A.14 TIME AND TIDE

LEVEL 3 2

Materials: *Three differently sized balls (the smallest represents the Moon, the middle one the Earth, and the largest the Sun), a hoop slightly larger than the ball representing the Earth (could be made out of stiff wire). This video may also help:* ***www.youtube.com/watch?v=KBTsESF1w-I.***

Discuss what you already know about the **tides** in your group. Ask your teacher/group leader to explain how **gravity** plays a role and how the Sun and the Moon both affect the **tides**. The strongest gravitational pull occurs between the Moon and the side of the Earth that is facing it, causing the ocean to be pulled towards the Moon. This causes a tidal bulge. Find out what **spring tides** and **neap tides** are and try to work out where the Sun and Moon might be when these occur.

1. To help understand how the turning of the Earth affects the **tides**, identify four volunteers to act out the movement of the Sun, Moon and Earth. One person needs to hold the Earth ball, a second needs to hold the hoop around the Earth representing the ocean, a third holds the Moon about 50 cm away from the Earth and a fourth holds the Sun a couple of metres away from the Earth (this is not to scale; if it were, the person holding the Sun would have to be about 200 metres away!).
2. First put the Earth, Moon and Sun in a straight line. Move the hoop so that the side closest to the Moon is as far away from the Earth's surface as possible. This demonstrates a **spring tide**.
3. Now put the Earth between the Moon and the Sun. What do you think happens to the ocean? Where should the hoop go? (Remember that despite the Sun being bigger, the gravitational pull of the Moon is stronger than the **gravitational** pull of the Sun, because the Moon is much closer to Earth).

4. Now put the Earth and Moon in line and the Sun at a right angle to the Earth. What happens to the ocean now? Where should the hoop go?
5. Draw a series of diagrams to explain the movement of the **tides** in relation to the Sun and the Moon.

Extension: Find out how the shape of the land affects the **tidal range**. Where in the world are the highest and lowest **tidal ranges**, and why? Try to find information on **tide** heights over a year at the coast closest to you. Plot the **tidal range** on a graph. What does this tell you? Why are the **tides** particularly high at certain times of year? If you can't get hold of **tidal range** data, think about how people use the **tides** and **tidal range** information. Why is it important for some people to know when high and low **tides** will occur? Present your findings to the rest of the group.

A.15 RIP CURRENTS

LEVEL 3 2

Materials: *Paper for making posters or leaflets, coloured pens and pencils or paints, internet access, rip current leaflet* ***www.ripcurrents.noaa.gov/signs/rip_brochure_final.pdf.***

Individually or in groups, find out about what causes **rip currents**, identify the signs that suggest there may be a **rip current** in the water and find out how you could escape from a **rip current**. Create a leaflet or poster explaining your findings and give a short safety talk to the group.

Extension: Find out how many people get into distress in **rip currents** each year at your local beach. Are there any life guards working on your beach? If yes, invite one to talk to your group about staying safe.

A.16 RUBBER DUCKS

LEVEL 3 2

Materials: *Internet access, article "Duck Ahoy":*
www.bbc.co.uk/cornwall/content/articles/2007/07/16/planetcornwall_rubberducks_feature.shtml

Read the article about the rubber ducks and their journey around the world. 29 000 toy ducks followed the surface ocean **currents** for 15 years following a shipping accident in 1992, before washing up in the United Kingdom in 2007. Write a story or a poem about the journey that the rubber ducks have had. Include some description within the story about the role of ocean **currents**.

Next, start your own voyage to learn more about **currents** around your local coast. Use bark or other natural materials to make small boats, set them off from your local beach and watch how they travel. For a few days after the launch, check nearby beaches to see if any have washed up. It is important to make your boats from natural materials so that you don't add to marine litter.

Extension: Why do fishers, sailors and other users of the sea need to know about **currents**, and how can **currents** help them? What other things have been found floating around the ocean? Walk along a beach and list the things you find. Where might they have come from? Put together a poster to explain what you've found out about ocean **currents**.

A.17 Do any other activity approved by your teacher or leader.
LEVEL 1 2 3

Next page: KURNIA SERFIYANI PUTTI, aged 13, INDONESIA

SECTION B:

THE OCEAN IS LIFE

DO EITHER B.1. OR B.2. AND (AT LEAST) ONE OTHER ACTIVITY OF YOUR CHOICE.

AFTER COMPLETING OUR THE OCEAN IS LIFE ACTIVITIES, YOU WILL BE ABLE TO:

* **EXPLAIN how food webs connect all life on Earth.**
* **TALK ABOUT different marine habitats and what kinds of marine life they are home to.**

DO ONE OF THE TWO COMPULSORY ACTIVITIES BELOW:

B.01 OCEAN LIFE

LEVEL 3 2 1

Materials: *Pictures of marine life, reference books or internet access, paper, coloured pens and pencils or paints, scrap materials for making a collage or model.*

Discuss life in the ocean. What is the biggest sea creature you can think of? What is the smallest? What lives at the coast and what lives out at sea? Have a look at the pictures and reference books and make a list of all the animals and plants that you can think of that live in the sea. Make a drawing, collage or model of what you think life underwater might look like. Put together an ocean display in a public place.

Extension: Do you know any marine biologists or other people who are knowledgeable about the sea? Is there a marine laboratory nearby? If yes, invite someone to talk to your group about marine life. If not, do a bit of research yourself. Find out about a marine animal or plant that interests you. How big is it? Where does it live? What does it eat and what eats it? How long does it live? Do people use it in some way? Present your findings to your group.

B.02 COAST VISIT

LEVEL 3 2 1

Materials: *Suitable clothing and footwear for walking, paper and pens, clipboards, a copy of the seashore code, a seashore guidebook (if available), a camera (optional).*

Particular caution and adult supervision required.

Some marine organisms are poisonous or can sting and should not be touched. Find out if there are any creatures to avoid at the beach you will visit beforehand.

Ask your teacher/group leader to organize a group visit to a beach at low **tide**. Before you go, make sure you read the seashore code and remember, even if you live next to the coast, don't go without an adult and make sure you tell someone where you are going and when you'll be back.
Look for animals and plants that live on the shore. Look by the water and higher up the beach; check underneath rocks, but be sure to put them back carefully as you found them. Are there any rock pools? What can you see in them? Can you see any holes in the sand? What might be living in them?
Draw pictures or take photographs of the animals and plants that you find. Do you know what they are? If yes, label each picture, if not, have a look in a seashore guidebook to find out. In tricky cases, take notes describing the plant or animal and look it up when you get home. Where did you find each animal? Why are they found there and what special features do they have to be able to survive there? Do you know what the food web looks like for these animals? Why not try drawing it!

Extension: Put together a display of some plants and animals you can find at your local beach to help your friends and family identify them. Feeling more ambitious? You could try putting together a whole guidebook...

CHOOSE (AT LEAST) ONE ADDITIONAL ACTIVITY FROM THE LIST BELOW:

B.03 WHICH ANIMAL AM I?

Materials: *Pictures of common marine animals and plants from your area.*

Before starting the game, the whole group should have a look at all the pictures. Think about how you might describe the animals and plants you see. Are there any similarities between them? Try sorting them into groups. Write down the common features of these groups. Once everyone is familiar with the pictures, mix them all up. Get one person to pick a picture and then describe it to the rest of the group without giving away the name. The group has to guess what animal or plant is being described.

Extension: Create your own marine life game. You could focus on animals and plants that you find at the beach nearest to you, or you could find out about any marine **habitat** that interests you and base your game on that instead.

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B.04 CENSUS OF MARINE LIFE

LEVEL

Materials: *Internet access, the Census of Marine Life Web site (**www.coml.org**), craft materials such as paper, coloured pens, pencils and paints.*

Have a look at the Census of Marine Life Web site, focussing in particular on the many weird and wonderful marine **organisms** that have been discovered. Find a **species** that you have never heard of before and bring it to life using any craft method you like. Talk about why, even though you haven't seen or heard of it before, this creature is important and what problems might be caused if it became **extinct**.

B.05 UNDERWATER MODEL

LEVEL 2 1

Materials: *Internet access or pictures of the deep seabed, glue, sticky tape, paint, paper, card, anything that might be useful to make a model (e.g. empty yoghurt pots and bottles, toilet rolls, plastic bags, straws...).*

100 years ago, most people thought the deep seabed was flat and featureless. New technologies have let us look at it more closely, and scientists have discovered a number of interesting features including long chains of mountains, volcanoes and hydrothermal vents, seamounts, oceanic islands and deep ocean trenches.

Find some pictures of these, e.g. the Monterey Bay Aquarium Research Institute's Web site on seafloor life: **www.mbari.org/topics/biology/bio-seafloor.htm**. Based on such pictures, create a model of the deep seabed. Which features are you including? Include some marine animals, too.

Extension: On the 26th March 2012, the film director and deep sea explorer James Cameron travelled to the deepest place on Earth: Challenger Deep in the Marianas Trench (10.99 km below the ocean surface). Find out more at: **http://deepseachallenge.com**. Write a short article about his journey. How long did it take him to reach the bottom of Challenger Deep? How long did he stay there? What did he see? What were the challenges he and his team faced in reaching the deepest place on Earth? How do you think he felt when he reached the bottom?

B.06 WHO EATS WHOM?

LEVEL 2 1

Materials: *Pictures of marine animals and plants ranging from smallest to largest; sticks or wire, string, scissors.*

Discuss marine **food chains**. Which animals are predators (eating other animals) and which animals are prey (being eaten by other animals)? Also talk about **herbivores** (animals that only eat plants), **carnivores** (animals that only eat other animals) and **omnivores** (animals that eat both other animals and plants). Can you name some marine **herbivores**, **carnivores** and **omnivores**? Where do humans fit in?

Use pictures or drawings of marine animals and plants to create a marine **food chain** mobile. Make a frame with sticks, wire or an old coat hanger. Start by attaching a top level **carnivore** like a shark, then use string to attach the next level of the **food chain** (e.g. carnivorous fish), then **herbivores**, then plants.

Extension: Pick one or two marine animals that you find interesting (e.g. whales, sharks, giant squid, seals, turtles...). Does anything eat them? What is their prey? What does their prey eat? What happens to them when they die? Draw a diagram of their **food chain**. You might find that their **food chain** is not a chain at all but a much more complicated **food web**.

GOOD IDEA

B.07 OCEAN DELICACIES

LEVEL 3 2 1

Materials: *Access to a kitchen and kitchen utensils.*

Particular caution and adult supervision required.

We humans are part of marine **food webs**, just like marine plants and animals! Use as many different ocean ingredients you can think of and prepare an ocean treat for your group. Remember that seafood doesn't only include fish and other sea creatures, but that there are many edible underwater plants, too. How about making sushi with seaweed and fish, for example? Learn about how your ingredients grew or developed, and how they were harvested. When you go shopping, try to make sure that the ingredients are locally or **sustainably sourced**. Is that difficult?

Extension: Why not invite your friends and family to a whole ocean banquet? Tell your guests everything you know about what they are eating and convince them of the importance of enjoying **sustainably sourced** ocean delicacies.

RODRIGO ALEJANDRO BERMÚDEZ ROSEY, aged 16, MEXICO

B.08 MAP THE COAST

LEVEL 3 2

Materials: *Clipboards, paper, pens, camera (optional), seashore guidebook, internet or reference book access.*

This can be a desk-based exercise, involve a visit to the coast or a mixture of the two. If you do visit the coast, read the seashore code before you go: **www.marlin.ac.uk/seashorecode.php**

In small groups, find out as much as you can about a piece of coast that interests you. Use books, pictures, photographs, the internet and ask people you know. If possible, visit the beach/coast, take photographs and measurements and make notes. Using your research, draw a map of the area showing where the different physical features are (e.g. areas of sand, rocks, rock pools, cliffs, mud), the coastal vegetation (e.g. salt marsh, mangroves, scrub) and human developments (e.g. houses, shops, other buildings, roads and car parks). Include some information about what you might find nearby offshore (e.g. is there a **reef** there?). What marine life do you think you will find in the different parts of the beach and just offshore? Each person in the group can draw a separate piece of the area. Join all the pieces together at the end to produce a big, thorough map.

Extension: Are there signs of environmental degradation or pollution? If so, what do you think might be causing this? Think about the different ways that people are using the piece of coast you have just mapped. How might these activities affect the **habitats** you have described? Ask yourself "What used to be in the places where the buildings are now?" If you don't know, ask someone who lives nearby. Annotate your map with some answers to these questions.

B.09 FILM THE COAST

LEVEL 3 2

Materials: *Access to wildlife documentaries, internet or reference book access, video camera or other recording device, microphone.*

Creating a short film will require careful planning. Do you know anyone who has made a film before? If yes, ask them for some advice. If not, have a look at existing wildlife documentaries to get some ideas. Pick your message: what do you want to tell people about? Research the coastal area where you want to make your film. What is special about the location? What are its most interesting features, plants and animals? Is there someone interesting you can interview about the beach? Is the area threatened by rising sea levels or coastal **erosion**? Is the area being properly looked after or is there litter and pollution? How is this affecting marine life? What can be done to protect the area?

Decide how long you want your film to be. Write a script before filming and try to get some feedback on it. Will you need any props when filming? Once you have completed the filming, hold a viewing in your community. You could also upload your film to the internet or submit it to a film competition for young people...

B.10 MARINE HABITATS

LEVEL 3 2

Materials: *Access to the internet or reference books.*

Split up into smaller groups and research a marine **habitat** other than your local beach. Find out where in the world your group's **habitat** is located, how marine life is adapted to living there and what human activities go on there. Find out if the **habitat** is endangered by environmental change or human activities. If so, what can be done to help? Take turns with the other groups to present what you have found. How are the **habitats** you have chosen similar and how are they different?

B.11 MARINE FAVOURITES

LEVEL 3 2

Materials: *Access to the internet and reference books, a computer and projector (optional).*

This activity should be carried out individually and independently. The aim is to give a short presentation to the rest of your group about your favourite marine animal or creature. Remember not all marine life lives in the **sea**, some of it lives next to it and some of it lives above it (e.g. birds). In your presentation, describe your **organism** of choice (what does it look like?), where you can find it around the world (what is its distribution?), how big its global population is (what is its abundance?), how people affect it, and any other interesting facts you find.

Extension: Just like on land, some marine **species** are endangered and under threat of **extinction**. Prepare a poster with details of ten endangered marine **species**, giving a few facts about each **species**, including how many of them are left in the wild and why they are endangered.

B.12

Do any other activity approved by your teacher or leader.

LEVEL 1 2 3

SECTION C:

PEOPLE AND THE OCEAN

DO EITHER C.1. OR C.2. AND (AT LEAST) ONE OTHER ACTIVITY OF YOUR CHOICE.

AFTER COMPLETING OUR PEOPLE AND THE OCEAN ACTIVITIES, YOU WILL BE ABLE TO:

* **IDENTIFY** the many ways humans rely on and use the ocean.
* **CONSIDER** different ways to manage marine resources sustainably.

DO ONE OF THE TWO COMPULSORY ACTIVITIES BELOW:

C.01 FISHY BUSINESS

LEVEL 3 2 1

Materials: *Notebooks or paper and clipboards, pens or pencils, a camera (optional).*

Organize a visit to your local fish market (if there is no fish market close by, you could visit a fishmonger or the fish counter at your local supermarket). How many different types of fish and shellfish can you see? Where have they come from? Are they deep sea fish or have they been caught near the coast? Who caught them? Were they local fishers or fishers from far away? How were they caught? Have any of the fish come from a fish farm? Draw pictures or take photos of the different seafood you see and make a big display. Add notes about the facts you discover to the images.

LEVEL 2 1

Extension: Has our use of seafood changed over the years? Gather recipes from grandparents, parents and recent cookbooks to see if the types of seafood we eat and the ways we prepare them have changed. Try making some of the recipes.

LEVEL 3 2

What is the nutritional value of seafood? Compare different fish and shellfish **species** with each other and with other kinds of food.

C.02 SEASIDE FUN

LEVEL 3 2 1

Materials: *Internet, magazine or newspaper access, cameras, paper, pens and pencils.*

There are all kinds of recreational activities to do at the beach. How many can you think of? Which ones have you already tried and which would you still like to try? Conduct a survey in your area to find out which activities people have done at the beach. Alternatively, go to your local beach and count how many people are taking part in the different activities. What is the most popular activity? Make charts to show your findings. Make sure you record the date of your visit. That way, if you or another member of your group visits the same beach on another day, you can compare your findings. Have the numbers changed? Why do you think that might be?

LEVEL 3 2

Extension: Read the article "How tourism is taking the turtles from Kenya's blue waters": **www.guardian.co.uk/environment/2011/dec/12/tourism-turtles-kenya-population**. Find out if tourism and recreation are having negative effects on the marine environment in your area. What can be done to help? As a group, put together an action plan to make sure tourism and recreation don't become a problem at your local beach, or at your favourite seaside destination.

CHOOSE (AT LEAST) ONE ADDITIONAL ACTIVITY FROM THE LIST BELOW:

C.03 OCEAN USE SCRAP-BOOK

LEVEL ● 2 1

Materials: *Pictures of activities we do in and things that we use from the ocean, paper and glue or sticky tape.*

Think about all the things people do at the coast, on the beach, in ports and harbours, out at sea, in the water or at the seabed. Next, think about the products or things that we use from the ocean: food, medicines, building materials, objects, etc. Make a scrap-book showing all these different uses and products.

Extension: Many uses of marine products are a bit hidden. Did you know, for example, that you probably put some seaweed in your mouth when you last cleaned you teeth? Many toothpastes contain a product called alginate that comes from seaweed. Find out more about how seaweeds are used. What food products or medicines contain seaweed? And how do farmers and gardeners use seaweed? Add this information to your scrap-book.

C.04 OCEAN EXPLORATION

LEVEL ● 2 1

Materials: *A world map, internet access: information about the HMS Challenger expedition, (e.g.* ***www.nhm.ac.uk/nature-online/science-of-natural-history/expeditions-collecting/hms-challenger-expedition*** *or* ***www.rmg.co.uk/whats-on/events/gallery-favourites-online/hms-challenger-and-the-creatures-of-the-deep****).*

Draw the route of the HMS *Challenger*'s expedition onto a map of the world. Write the names of the new species they discovered on the map. How many were there in total?

Watch the video about the HMS *Challenger* expedition on the United Kingdom's Natural History Museum's Web site and gather further information about the expedition. Talk about what life might have been like on the boat if you were a member of the crew. Write two letters home, one as if you were a member of the crew and one as if you were a scientist. Explain your day-to-day routine and what life at **sea** is like. Are you homesick at all?

C.05 A DAY IN THE LIFE OF A FISHER

LEVEL 3 2 1

Materials: *Paper and pens or pencils, internet access (optional).*

Do you know any fishers? If not, is there a fishing port nearby? Invite a fisher to talk to your group about his or her day-to-day activities. Prepare some questions for them to find out more! For example, what time do they get up and leave home in the morning? How long do they stay at **sea** for? What do they do when they first get on their boat? Where do they take it? What are they trying to catch? What fishing gear do they use? How long do they leave their gear in the **sea**? What do they do with the fish that they have caught? Do they go fishing all year round? What do they do when the **weather** is bad? Do all fishers have the same experiences? If you can, interview different fishers who use different types of fishing gear or have different sized boats. How do their days differ? After they have gone, write a story about a day in the life of a fisher.

C.06 BOATS AND SEAFARERS

LEVEL 3 2 1

Materials: *Craft materials (e.g. bottles, pipes, yoghurt pots, plastic sheeting, small pieces of wood, aluminium foil, paper, card, string, glue, sticky tape) – anything you think you might need!*

Particular caution and adult supervision required.

The challenge is to build a small boat that floats and doesn't tip over (capsize). The boat that carries the greatest pretend **cargo** wins (any small items, like coins, grains of rice or even an apple). What do you think will help keep your boat upright and balanced? Draw a design for your boat before you start.

Once everyone has made their boat, find somewhere calm to test them. If you go to a pool, a river, lake or at the beach, take the necessary safety precautions. Otherwise you could fill up a bath, sink or large plastic tub.

Extension: Many of the early **seafarers** and explorers made long sea voyages in an open sailing boat. Write a short story or poem imagining what that would have been like (e.g. how frightening it must have been when the **weather** turned bad!).

LORD AHZRIN D. BACALLA, aged 12, PHILIPPINES

C.07 HOW FISHERS CATCH FISH

LEVEL 3 2

Materials: *Internet or reference book access to pictures and information about different fishing gear (e.g.* ***www.fao.org/fishery/geartype/search/en; www.youtube.com/watch?v=g1TPeM9EAK0; www.youtube.com/watch/?v=MdkU678ZwjA****).*

Organize a debate about the **sustainability** of fishing and the use of different fishing gear and practices. Each person in the group has to research the pros and cons of a different type of fishing gear. You may also want to find out about differences between artisanal and industrial fishing. Each person should make a short presentation about why their form of fishing is best. Once you have finished your presentations, invite the audience to ask questions. When all the questions have been discussed, ask the audience to vote on which form of fishing they think is most sustainable.

C.08 ALL ABOUT AQUACULTURE

LEVEL 3 2

Materials: *Internet access: information about* **aquaculture** *(e.g.* ***www.montereybayaquarium.org/cr/cr_seafoodwatch/content/media/MBA_SeafoodWatch_AquacultureFactCards.pdf****).*

Individually or in small groups find out all you can about **aquaculture** and the types of **aquaculture** that take place in your country. Invite someone who works in **aquaculture** to speak to your group about their experiences to help with your research. Prepare a presentation explaining what **aquaculture** is and why we need it, as well as its benefits and disadvantages.

Extension: Many new approaches to reduce **aquaculture**'s environmental impact are being developed, such as mixed **aquaculture** that produces seaweeds, **bivalves** and fish all together. Spend a few minutes at the end of your presentation talking about these. Why do you think they haven't been taken up more quickly by the industry and how could this be encouraged?

C.09 TRANSPORT AND TRADE

LEVEL 3 2

Materials: *A visit to your local port or harbour, a camera. OR information materials about your nearest port or harbour.*

Visit your local port or harbour as a group. If this is not possible, gather information about your nearest port or harbour instead. What **cargo** passes through the port or harbour? How much **cargo** passes through in a year? How many people leave or enter the port or harbour every year? How many boats and ships use it every year? How big are the biggest ships there? Put together a leaflet or poster display describing the activities that go on there.

C.10 OCEAN STUDIES

LEVEL 3 2

Materials: *Internet access (e.g.* ***http://changingoceans2012.blogspot.co.uk****) or reference materials about marine expeditions.*

Choose a marine **ecosystem** that interests you (e.g. the deep sea, the open ocean, coral **reefs**, mangroves, salt marshes, rocky shores) and think about what you would like to find out about it. How do you think scientists would go about answering your research questions? Imagine you have the opportunity to carry out some fieldwork to collect data about this **ecosystem**. How would you choose to go about it? For example, would you use satellite data? Would you need to do a survey by boat? Could you take samples from the shore? Write a research plan.

Extension: Is there a marine laboratory near to where you live, or are there any commercial businesses that undertake marine research and expeditions in your area (e.g. hydrographic surveyors, businesses that explore the marine environment looking for oil, gas and minerals)? Visit the organization, or invite an expert to give a talk to your group about studying and working in the marine environment.

C.11 EXPLORING THE POLAR SEAS

LEVEL 3 2

Materials: *Access to reference materials on the Arctic or internet access (e.g.* ***www.discoveringthearctic.org.uk; http://oceans.digitalexplorer.com/resources/frozen-oceansinternational-resources/#cmp****).*

Imagine you've just been offered the opportunity of a lifetime to join the next expedition to the Arctic to explore how human activities are affecting the ocean in polar regions. What research question do you think your team of researchers should focus on? What experiments or observations would you carry out? How long will you go for? What will you need to take with you, not just for your experiments, but also to eat, sleep and stay healthy? Write a short diary about your preparations, your trip and the discoveries you've made. What lessons have you learnt and what is your key message for people at home?

Extension: Many people live in the Arctic and near the Arctic and depend on its **natural resources**. Find out how **climate change** and melting sea ice is changing the way that they live and how it is affecting the whole world. Include what you have found out in your explorer's diary.

C.12 Do any other activity approved by your teacher or leader.

LEVEL 1 2 3

HANIFAH ADIYANI TANGKO (HANI), aged 16, INDONESIA

SECTION D:

THE OCEAN AT RISK

DO EITHER D.1. OR D.2. AND (AT LEAST) ONE OTHER ACTIVITY OF YOUR CHOICE.

AFTER COMPLETING OUR THE OCEAN AT RISK ACTIVITIES, YOU WILL BE ABLE TO:

* **DESCRIBE** many ways in which human activities may affect or threaten ocean life.
* **SUGGEST** ways to reduce these impacts.

DO ONE OF THE TWO COMPULSORY ACTIVITIES BELOW:

D.01 SMALLER FOOTPRINTS

LEVEL 3 2 1

Materials: *Internet or reference book access to information about the ocean and* **climate change**.

Discuss the impacts of **climate change** on the ocean and how these might affect people. Make a list of all the ways that human activities impact on **climate change** and therefore ocean life. What can be done to reduce these impacts? How can you, your family, friends and community support this? Create a list of everyday activities that you can easily change to help reduce your **greenhouse gas** emissions (e.g. get ideas from **www.epa.gov/climatestudents/solutions/actions/index.html**). Choose three ways to reduce your **greenhouse gas** emissions and commit to making these changes. Revisit this challenge after two weeks to see how you are getting on. Renew your pledge and commit to keep going!

D.02 MARINE MEDIA

LEVEL 3 2 1

Materials: *Information about your local coast and how human activities are affecting it. Other materials as appropriate (e.g. a video camera, craft materials, etc).*

Create a short film, photo-story, play or podcast explaining how humans affect the ocean and coastline near you and how this in turn affects the local community. Decide on your message: what do you want to tell people about? What do people use the area for? What is special about this location? What animals and plants live there and how might they be affected by tourism, trade, industry or any other human activity? What can be done to protect the area? How can people help?

Find a way to share your completed project. If you made a film or photo story hold a screening, submit it to a festival or upload it onto the internet. If you wrote a play, perform it for your friends, family and community – perhaps you could even invite local politicians? Try to get your podcast broadcast on local radio, or upload it to the internet.

CHOOSE (AT LEAST) ONE ADDITIONAL ACTIVITY FROM THE LIST BELOW:

D.03 RISING TEMPERATURES, RISING SEAS

LEVEL ● 2 1

Materials: *A large tray or pan (at least 10 cm deep), a rock or brick (to represent an island), a waterproof marker pen, ice cubes, water.*

1. Place your 'island' in the pan (why not decorate it with trees, houses and people?). Pour cold water into the pan until the bottom of the island is covered. Add some ice cubes to the pan (you will need quite a few), representing the sea ice found in the Arctic and Antarctic. Mark the level of the water on the side of the 'island' before the ice has melted. Leave the pan until all the ice has gone. Mark the water level on the island again. What has changed?

2. Now set up your island as before, but instead of placing the ice in the water, put the ice on your island. This ice represents the ice in glaciers and on mountain tops. Make sure you mark the water level before the ice has melted. Once all the ice has gone, what has changed? How do the findings from part 2 of the experiment differ from the findings in part 1? Why do you think that is? What does this mean for global sea level rise?

D.04 POLLUTION AND ACCIDENTS

LEVEL 3 2 1

Materials: *Internet or reference book access, paper and coloured pens, pencils or paints. If possible, a visit to the site in question, a camera (optional).*

Have there been any major marine pollution incidents in your area (e.g. an industrial accident or illegal waste-dumping)? What happened? What were the effects on ocean plants and animals? What is being done to help reverse these effects? Create a banner illustrating the sequence of events and their knock-on effects.

Extension: If you work in smaller groups, you can create banners for different incidents, and then compare them. Which incidents were dealt with most successfully? Which are still a problem?

GOOD IDEA

D.05 OCEAN ACIDIFICATION

LEVEL 3 2 1

Materials: *Internet access:* ***www.youtube.com/watch?v=55D8TGRsl4k****. Three small jars, water, vinegar or fruit juice, carbonated water, seashells (or egg shells, pieces of dead coral or sea urchin skeleton),* **pH** *indicator strips (can be bought in many pet shops or garden centres. If you can't find any, you can make your own* **pH** *indicator solution using red cabbage* ***http://science.howstuffworks.com/innovation/everyday-innovations/experiment1.htm****).*

1. Once you have watched the animation discuss what you have learnt. What is acidity? How is acidity measured using a **pH** scale? Why is the ocean becoming more acidic? What are the impacts of **ocean acidification** on marine life? Why might this be important to you and your friends and family?
2. Next, in small groups, take three jars. Pour some tap water into one, some vinegar or some fruit juice into the second and some carbonated water in the third. What do you think the **pH** of each liquid is? Measure it using your **pH** strips and note it down.
3. Examine the seashells (or alternative items) and write down their size or weight. Add a shell (or similar) to each jar and make sure it is completely covered by the liquid. What do you think will happen?
4. Check the jars every hour and record your observations. What is happening to the shell in each liquid? Then check your shells every day for a week and record what you see.
5. After a week, remove your shell from the liquid, allow it to dry and weigh it again. What has happened? Can you explain it?

Extension: Design some publicity information to raise awareness about **ocean acidification** (e.g. a cartoon strip, a poster, a newspaper article, a short radio programme or video clip). Circulate the information as widely as possible.

GOOD IDEA

D.06 ALIEN INVASION!

LEVEL 3 2 1

Materials: *Internet or reference book access, a blank sketchbook, coloured pencils and pens or paints.*

An environmental problem often associated with marine transport is that of **invasive species**, who become established in new areas and threaten the **species** already living there. Find out if there are any **invasive marine species** in your area. If there are no **invasive species**, find out about a marine **invasive species** of your choice. Create a short comic book using all the information you have found to tell the story from the point of view of the native **species**. Where have the 'aliens' come from? When did they first appear? What problems are they causing and what, if anything, is being done to control them? Is there hope for the native **species**?

ANDI TENRIBALI HIKMAH NAPACCE, aged 8, INDONESIA

D.07 OVERFISHING

LEVEL 3 2

Materials: *Internet or reference book access, fisher(s) to interview.*

Try to find out about how fishing has changed over the years. Research facts and figures on your own, but, if possible, interview a fisher (or several) and ask them questions (this activity can be linked to Activity C.5.). How long have they been fishing for? Have they noticed any changes (e.g. fish size, type of fish caught, time and place required to capture the fish, fishing regulations, etc.)? How does this compare to what older fishers have told them about fishing in the past? Why do they think these changes have occurred? Are they worried about the future of fishing? Do they expect their children to become fishers too, and if not, why not? Write a description of what you have been told in the style of a newspaper article.

Extension: Fisheries management is extremely complicated. It aims to avoid **overfishing**, but also needs to consider issues like equality and fairness. Find out what fishers have to do to sell their catch: how do they get their fish to market? Do they sell their fish themselves, or does someone else sell it on their behalf? Do they have any experience with **certification schemes** and **ecolabelling**? Do they work together to promote their interests (e.g. in a cooperative)? Also explore some wider issues, such as: what is the role of women in fisheries? Are there any disagreements fishers have to think about (e.g. with other users of the **sea**)? Do fishers think current fisheries management is effective – and if not, why not? What are local or national authorities doing, and what do fishers think they should do better?
Write a newspaper article from the perspective of the fishers you have talked to. Why not try to get your article published? Ask your local newspaper, or if you know about making Web sites, upload it onto the internet. You could even compare the situation you have learnt about with some research on fishers' experiences in other areas of the world.

D.08 WARMER WATERS

LEVEL 3 2

Materials: *Materials to build a model* **reef** *(e.g. white and coloured paper, cardboard tubes, coloured plastics, pieces of wood, etc.).*

Corals are fascinating creatures. Many people think they are made of stone, but they are actually made up of colonies of coral 'polyps': tiny, individual animals, with a jelly-like body and tentacles. Coral polyps build themselves hard outside structures (like skeletons) to protect and support their soft bodies. These hard structures help form corals **reefs**. Corals are different colours because small algae (called zooxanthellae) live inside their structures. These small algae use **photosynthesis** to produce food which is released to the coral polyp in exchange for the protection that they provide. When the **seawater** gets too warm, the algae start producing toxins which harm both themselves and the coral polyps. The polyps then reject the algae, even though they need them to survive. Without the algae, the corals look white. The white (or bleached) corals become more vulnerable to disease. Many corals do not recover from bleaching and die.

In small groups, using the materials you have collected, build a model of a coral **reef**. Make part of it a healthy **reef** and the other part a bleached **reef**. Include labels to explain what has happened to the bleached **reef**.

Extension: What do changing sea temperatures mean for other marine **species** and the **food webs** they support? Find out and make a presentation to the rest of your group.

D.09 MPA DEBATE

LEVEL 3 2 ●

Materials: *Internet access:* ***http://education.nationalgeographic.com/education/encyclopedia/marine-protected-area/?ar_a=1&ar_r=3#page=1.***

Read the article by the National Geographic about **Marine Protected Areas** (MPAs) and discuss their advantages and disadvantages for people and marine life. Act out a role-play to decide whether your local beach and surrounding area (or another place on the coast you have visited) should be made into a **Marine Protected Area**. Think about all the different people who might be affected by an **MPA**, including the people who currently use the area (e.g. tourists, fishers), the businesses that support them (e.g. local hotels, developers, leisure providers, fishing shops or markets), those who will enforce the **MPA** (e.g. local authorities), those who are campaigning for the **MPA** (e.g. conservation organizations) and the general public. Designate a role to everyone in your group (but keep one person as a chair). Each individual needs to think about the reasons why they think the **Marine Protected Area** is a good or bad idea, and how it might benefit or disadvantage them. Debate with or against the opinions of other users – try to find compromises to align your interests. Invite an audience to listen to your debate. The chair gives everyone a few minutes to speak, after which the audience gets to ask questions, too. The chair makes sure everyone has a fair chance, and that nobody speaks for too long. He or she also summarizes the key issues at the end of the debate, after which the audience is asked to vote. Should there be an **MPA** or not? How should it be designed, implemented and managed?

This activity is based upon one developed by the Marine Education Trust, who gave their permission for its use.

D.10 Do any other activity approved by your teacher or leader.
LEVEL 1 2 3

SECTION E:

TAKE ACTION

DO EITHER E.1. OR E.2. AND (AT LEAST) ONE OTHER ACTIVITY OF YOUR CHOICE.

AFTER COMPLETING OUR TAKE ACTION ACTIVITIES, YOU WILL BE ABLE TO:

* **ORGANIZE** and participate in a community initiative to help protect the ocean.
* **CONVINCE** other people to join in the efforts to protect the ocean!

DO ONE OF THE TWO COMPULSORY ACTIVITIES BELOW:

E.01 BEACH CLEAN

LEVEL 3 2 1

Materials: *Buckets or bags for collecting rubbish, gloves, scales, pens and paper, glue, a camera (optional).*

Particular caution and adult supervision required.

Visit your local beach or coast and try to collect as much rubbish as you can find. Make sure you use gloves to protect your hands and if you find sharp objects or anything that you are unsure of, get an adult to take a look first and decide if you should pick it up or not. Once you have finished, put all the rubbish together in a big pile. What have you found? Sort the rubbish into different types, such as plastic bottles, plastic bags, glass, cans, rope and so on. Count the number of pieces of rubbish you have of each type and then weigh them. What do you have the greatest number of? And what weighs the most? Taking examples of the different types of rubbish, use them to make a display (make sure they are clean first) in your meeting place. Include labels saying how many pieces and the weight of that type of rubbish you found. Invite your friends and parents to see the results of your work. See if you can find out about companies and organizations with clever ideas for turning marine rubbish into something useful, for example: **www.theffrc.com**

Extension: Find out about how long different items of rubbish last in the marine environment. Some things will break down quite quickly, while others take much longer. Also find out about the dangers of rubbish to marine life. Add this information to the labels on your display.
You could also get the media involved. Invite a local journalist or radio presenter to join your beach clean. If no one is available, write a report about the event for the local newspaper. Include some photos.

E.02 OCEAN CAMPAIGN

LEVEL 3 2 1

Materials: *Will vary according to your individual campaign needs.*

Discuss any problems at your local beach or in your local coastal area that you would like to change with your group. Or is there an issue nationally or internationally that you think people in your area should be aware of (e.g. **overfishing**, pollution, coastal development or **climate change**)? Start an awareness-raising campaign. Think about things like: who is your audience? How will you reach it? How long should your campaign last? What outcomes would you like to achieve?

There are many ways that you can reach your audience. You could start by writing a letter to people in your community to persuade them to change their behaviour. You could make posters informing people of the problem and put them in conspicuous places around your community. You could hold an event, giving presentations and handing out leaflets explaining the issue. You could try to get the local media involved. You could make your own film or radio programme (ask some professionals for help). What other ways can you think of?

CHOOSE (AT LEAST) ONE ADDITIONAL ACTIVITY FROM THE LIST BELOW:

E.03 BAG IT!

LEVEL 3 2 1

Materials: *Old items of clothing or other unwanted material, needle and thread (or a sewing machine), a pattern for making a shopping bag (design your own or try* ***http://tipnut.com/35-reusable-grocery-bags-totes-free-patterns****).*

Encourage your family to use cloth or hemp shopping bags. How about making your own? If you and your group can make enough of them, you could ask your local shop to start using them or give them away outside your local shop or shopping centre, explaining to shoppers what you are doing and why.

Extension: How many other ways can you find to avoid overusing plastic? For example, you could start using reusable bottles, buying unpackaged fruit and vegetables...

E.04 SUSTAINABLE SEAFOOD

LEVEL 3 2 1

Materials: *Internet access:* ***www.montereybayaquarium.org/cr/cr_seafoodwatch/sfw_consumers.aspx*** *and* ***www.msc.org/cook-eat-enjoy/fish-to-eat****.*

Many common fish that we see at fishmongers or in shops are in danger because of **overfishing** or because the way they are caught or farmed damages the marine environment and other marine **species**. Discuss what you know about fishing, using the information provided by the Monterey Bay Aquarium or the Marine Stewardship Council. Which types of seafood are most **sustainable**? What recipes can you find for cooking with them? Encourage your family and friends to buy **sustainably sourced** seafood. You can also join established campaigns (e.g. take the Monterey Bay Aquarium's seafood watch challenge: sign up to be a Seafood Watch Advocate and take part in Seafood Watch activities throughout the year).

You can take this even further by trying to encourage your local restaurants, cafés and shops to do the same or to buy from suppliers that only sell **sustainably** caught or farmed seafood.

Extension: Look at the criteria that different guides and labelling programmes use to define '**sustainability**'. For example, FAO has developed guidelines for the **ecolabelling** of fish and fishery products from marine capture fisheries which may be helpful (**www.fao.org/docrep/012/i1119t/i1119t00.htm**). Try to find out where **certification** has been used and what has happened to fisheries and the environment in areas producing **ecolabelled** seafood. Why not create your own **ecolabel**? Think about the **sustainability** issue you want to address, and how you could do this. Don't forget to design an eye-catching logo!

E.05 WORLD OCEANS DAY

LEVEL 3 2 1

Materials: *Internet access:* ***http://worldoceansday.org*** *and* ***http://worldoceansday.org/?page_id=59****.*

Every 8th of June is World Oceans Day, a day dedicated to celebrating the beauty and importance of the ocean. Organize a day of celebration at your school or in your community. The World Oceans Day Web site has a number of ideas of things that you can do: perhaps you could design a logo for a t-shirt especially for the day, organize a treasure hunt, hold a sand sculpture competition or have a beach party. You could also use the event to display the materials you have produced from other activities you have completed as part of this challenge badge.

LEVEL 3 2

Extension: World Oceans Day has been officially recognized by the UN since 2009. Why not organize your own model United Nations? Talk about international issues that affect the ocean, and the kind of solutions being implemented in your own country and abroad.

E.06 CITIZEN SCIENCE

LEVEL 3 2 1

Materials: *Notepad and pen.*

There are many opportunities to take part in citizen science: research projects around the world rely on the public to provide them with information! Find out about opportunities in your area, and if there aren't any at the moment, why not set up a new one for **species** of interest in your area? You could ask organizations that run similar programmes elsewhere for advice.

One of the most well-known in the marine environment is Jellywatch (**www.jellywatch.org**). Jellyfish are becoming increasingly common along many stretches of coast, and because they can affect many human activities (such as swimming or fishing), scientists are investigating their presence. The next time you are at the coast, take a notepad and pen with you and if you see a jellyfish, write down a description of it and where you saw it. Jellywatch is also interested in other marine life, such as red tides (a **harmful algal bloom**), squids and anything else that you think is unusual for your area.

Other organizations are also interested in things like sightings of whales and dolphins (e.g. the Whale and Dolphin Conservation Society **www.wdcs.org/index.php** and the Seawatch Foundation **www.seawatchfoundation.org.uk**).

E.07 OCEAN VOLUNTEER

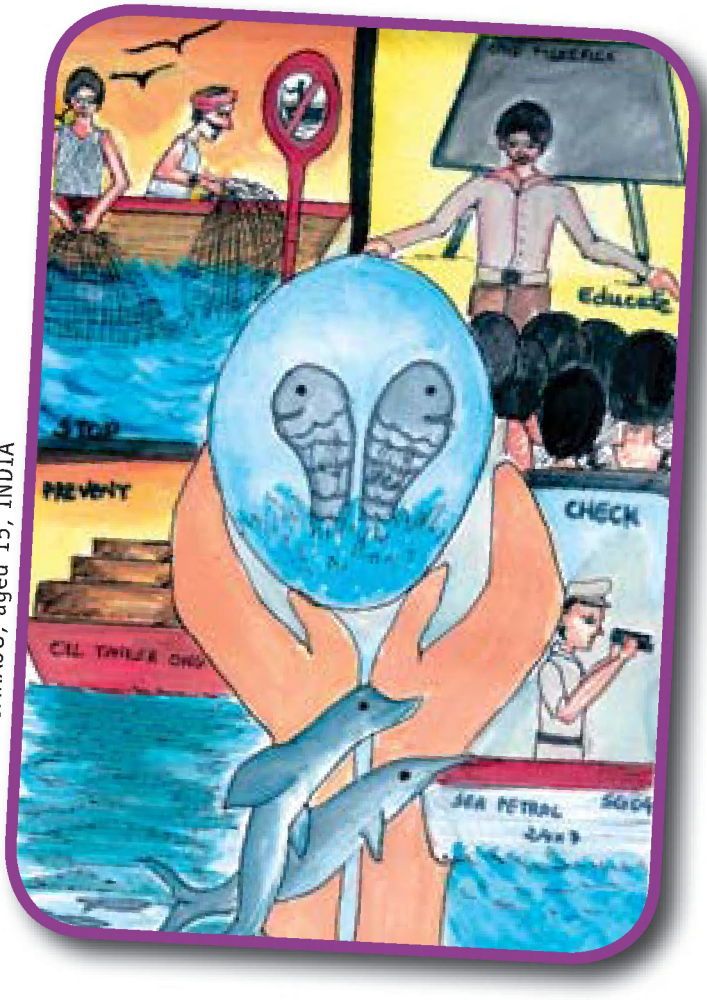
LEVEL 3 2

Materials: *Will vary according to task chosen.*

Volunteer for a few hours each week over a couple of months with an ocean-related organization that interests you. This could be a coastal conservation organization, an ocean research institute, your local aquarium, an **aquaculture** farm or any other group that seems worthwhile to you. How about keeping a blog (or diary) about your experience? Then you can tell your friends, family and the wider world about your contribution to ocean conservation or **sustainable** ocean use, and share what you are learning with them. You could encourage your readers to get involved too...

E.08 Do any other activity approved by your teacher or leader.

LEVEL 1 2 3



ANVITHA DESARAJU, aged 15, INDIA

CHECKLIST

Keep track of the activities you are undertaking in this checklist. When you show that you have completed them, you will have earned the Ocean Challenge Badge!

YOUR NAME: .....

YOUR AGE: 1 (5 to 10 years) 2 (11 to 15 years) 3 (16+ years)

Activity n°	Activity name	Completed on (date)	Approved by (leader's signature)
A	**Ocean in motion**		
B	**The ocean is life**		
C	**People and the ocean**		
D	**The ocean at risk**		
E	**Take action**		

YOUR NOTES

RESOURCES AND ADDITIONAL INFORMATION

STAY UPDATED

This challenge badge is one of several complementary resources and activities developed by YUNGA and its partners. Please visit **www.yunga-un.org** for additional resources or subscribe to the free news letter to receive updates of new materials by sending an email to **yunga@fao.org**

SEND US YOUR NEWS

We would love to hear about your experience of undertaking the challenge badge! Which aspects did you particularly enjoy? Did you come up with any new ideas for activities? Please send us your materials so we can make them available to others and gather ideas about how to improve our curricula. Contact us at **yunga@fao.org**

CERTIFICATES AND BADGES

Email **yunga@fao.org** for certificates and cloth badges to reward course completion! Certificates are FREE and cloth badges can be purchased. Alternatively, groups can print their own cloth badges; YUNGA is happy to provide the template and graphics files free of charge on request.

WEB SITES

All of the Web sites below contain links to educational materials about the ocean, including lesson plans, experiments, articles, blogs and videos.

THE BRITISH BROADCASTING CORPORATION (BBC) has an ocean page in its science and nature section:
www.bbc.co.uk/nature/blueplanet

THE CONVENTION ON BIOLOGICAL DIVERSITY produced a publication called Marine Biodiversity – One Ocean, Many Worlds of Life (2012):
www.cbd.int/idb/doc/2012/booklet/idb-2012-booklet-en.pdf
Additional information is available at:
www.cbd.int/idb/2012

ENCHANTED LEARNING provides free and fun activity ideas on ocean issues:
www.enchantedlearning.com/themes/ocean.shtml

THE FAO FISHERIES AND AQUACULTURE DEPARTMENT will give you access to facts and research on fisheries and aquaculture around the world:
www.fao.org/fishery/en

FEEDING MINDS, FIGHTING HUNGER includes a series of lessons called 'Wonders of the Oceans': **http://www.feedingminds.org/fmfh/fisheries-aquaculture/wonders-of-the-oceans/en**

United Nations Educational, Scientific and Cultural Organization

Intergovernmental Oceanographic Commission

THE HARMFUL ALGAL BLOOM PROGRAMME explains what harmful algae are and their effects on the environment and humans: **http://ioc-unesco.org/hab/index.php?option=com_content&view=article&id=5&Itemid=16**

THE INTERNATIONAL TSUNAMI INFORMATION CENTRE (ITIC) offers resources for tsunami education, including teachers' guides, posters and much more: **http://itic.ioc-unesco.org/index.php?option=com_content&view=category&layout=blog&id=2000&Itemid=2000&lang=fr**

NATIONAL MARINE AQUARIUM

JUST ADD H2O is the educational webpage of the UK's National Marine Aquarium: **www.justaddh2o.tv**

THE MONTEREY BAY AQUARIUM has an animals and activities page: **www.montereybayaquarium.org/efc/default.aspx?c=tn** as well as a site dedicated to teachers: **http://www.montereybayaquarium.org/lc/teachers_place**

NATIONAL GEOGRAPHIC has an ocean education programme, too: **http://education.nationalgeographic.com/education/program/oceans-education/?ar_a=1**

THE NATIONAL OCEAN SERVICE offers an educational page: **http://oceanservice.noaa.gov/education**

THE OCEANS FOR YOUTH FOUNDATION produces materials for underwater education: **www.oceansforyouth.org**

THE OCEAN PORTAL of the Smithsonian National Museum of Natural History will tell you how the ocean has influenced human culture and how you can get involved: **http://ocean.si.edu/ocean-news/how-you-can-help-ocean**

THE SCIENTIFIC EDUCATIONAL RESOURCES AND EXPERIENCE ASSOCIATED WITH THE DEPLOYMENT OF ARGO PROFILING FLOATS IN THE SOUTH PACIFIC OCEAN (SEREAD) Web site provides teaching materials based on the oceanographic findings of Argo Floats: **www.argo.ucsd.edu/SEREAD.html**

TREASURES @ SEA is a Web site that lets you explore the ocean through literature: **www.fi.edu/fellows/fellow8/dec98/intera.html**

THE TSUNAMI INFORMATION CENTRE FOR THE NORTH-EASTERN ATLANTIC, THE MEDITERRANEAN AND CONNECTED SEAS (NEAMTIC) offers a lesson plan on tsunamis and other ocean hazards: **http://neamtic.ioc-unesco.org/test/76-portfolio-item031**

THE US NATIONAL OCEAN AND ATMOSPHERIC ADMINISTRATION (NOAA) Web site provides educational materials focusing on expeditions and explorations: **http://oceanexplorer.noaa.gov/edu/materials.html**

NOAA'S ADOPT A DRIFTER PROGRAM invites school groups to adopt a 'drifter' and track the measurements it makes! Find out more and look into the lesson plans provided: **http://www.adp.noaa.gov/index.html**

WORLD OCEANS DAY is celebrated every year on June 8th. You can find ideas and featured stories from around the world here: **http://worldoceansday.org**

GLOSSARY

ABSORB: To take something up or retain it. For example, both the ocean and the atmosphere take up heat from the Sun's rays.

AQUACULTURE: The farming of marine life (fish, shellfish or seaweed), usually in cages, ponds or, in the case of **bivalves**, on ropes or racks.

BALLAST: A heavy material carried by ships to help stabilize them and prevent capsizing.

BALLAST WATER: Water held in tanks in large ships to keep them stable.

BAYS: A body of **seawater** that is partially enclosed by land, such as the Bay of Bengal, the Bay of Biscay or Baffin Bay.

BIODIVERSITY: A measure of how many different types of marine life forms there are in a particular place.

BIVALVES: Marine and **fresh water molluscs** whose bodies are enclosed inside two shells that are hinged together. They mainly feed by filtering particles out of the water.

BY-CATCH: Most fishers set out to catch specific kinds of fish, but are likely to catch other fish unintentionally while doing so. These unintentionally caught fish are known as **by-catch**.

CARBON DIOXIDE: A gas made up of carbon and oxygen, which makes up less than one percent of the air.

CARGO: The goods or produce transported by ships (or other forms of transport).

CARNIVORES: These are animals that gain all (or the majority) of their nutritional needs from eating other animals. 'Carnivore' literally means 'meat eater'.

CERTIFICATION SCHEMES: Certification schemes establish a set of rules and conditions that ensure **natural resources** are produced or **sourced sustainably** (without damaging the environment). Also see **ecolabelling**.

CHEMOSYNTHESIS: A biological process that involves the use of inorganic substances such as methane and hydrogen sulphide as a source of energy to convert carbon molecules and **nutrients** into organic matter. It is an alternative to **photosynthesis** for producing food when no light is present (e.g. on the deep sea floor).

CLIMATE: The long-term average, or overall picture, of the everyday **weather** experienced in a particular place.

CLIMATE CHANGE: A long-lasting change in **weather** patterns that may occur over long periods, lasting decades to millennia. It is caused by many factors including human activities, **volcanic** eruptions, changes in ocean **currents** and changes in the activity of the Sun.

COLD SEEPS: These are found on the ocean floor where hydrogen sulphide, methane and other hydrocarbon fluids escape from the ocean floor. The animals found here use **chemosynthesis** to produce food.

CONDENSATION: The change of a gas or vapour into a liquid; this process is called condensation.

CURRENTS: Continuous and directed movements of water. In the ocean they are caused by the **tides**, wind and differences in the temperature and **salinity** of **seawater**.

CYCLONE: See **hurricane**.

DEAD ZONES: These are areas of the ocean, often close to the coast, where little oxygen is found in the water and sediments making it difficult for marine life to live there. The number of **dead zones** in our ocean is growing.

DEBRIS: Discarded waste, the remains of something that has been destroyed.

DELTAS: Fan-shaped areas of usually muddy soils at the mouth of a river that are crossed by streams and channels.

DENSITY: The mass (or weight) of something relative to its volume. For example, a 1 cm^3 piece of rock weighs more than a 1 cm^3 piece of foam because it is more dense.

DESALINATION: The process by which salt is separated from water, so that pure water is left behind. For instance, when water **evaporates**, the salts and minerals dissolved in it are left behind.

DETRITIVORES: Important **organisms** for decomposition: detritivores satisfy their nutritional needs by eating the dead bodies or **debris** of other animals and plants, and the waste products of other animals.

DEVELOPING COUNTRY: A poor country that is trying to become more economically advanced. Developing countries tend to rely heavily on subsistence farming or fishing (where farmers or fishers grow, raise or catch enough food only to feed their families, and rarely produce enough to sell on to earn a living).

DILUTED: Made thinner or weaker, for example by adding water.

EARTHQUAKE: A sudden large movement of the Earth's crust.

ECOLABELLING: Ecolabels are symbols placed on the packaging of seafood to show that it meets an agreed environmental standard under an appropriate **certification scheme**.

ECOSYSTEMS: A community of living **organisms** (plants and animals) and non-living things (water, air, soil, rocks, etc.) interacting in a certain area. Ecosystems don't have a defined size: depending on the interactions you are interested in, an ecosystem can be as small as a puddle or as big as the entire ocean. Ultimately, the whole world is one big, very complex ecosystem.

EGGS: Female reproductive cells, which are fertilized by **sperm** to create young.

EROSION: Erosion means 'wearing down'. Rocks and soils are eroded when they are picked up or moved by ice, water, wind or **gravity**.

ESTUARY: A type of river mouth into which the sea enters, causing a mixing of **fresh water** and **seawater**.

EUTROPHICATION: Caused by the presence of excessive levels of **nutrients**. This often occurs in coastal waters. Eutrophication results in the fast growth of **phytoplankton** and other marine algae which can contribute to the creation of **dead zones**.

EVAPORATION: The process by which heat turns a liquid substance into gas or vapour.

EXTINCTION: When a particular **species** is no longer alive on Earth, it is 'extinct'.

FRESH WATER: Naturally occurring water that is not salty (e.g. in rivers, lakes and **groundwater**).

FRY: Animal young (e.g. baby fish).

FOOD CHAINS: The links between **organisms**, showing what eats what. Food chains show how energy passes between individuals, starting with **primary producers** (plants) all the way up to **carnivores** and **detritivores**.

FOOD WEBS: This is a more complicated version of a **food chain**, showing that different animals may sometimes eat the same thing.

GRAVITY: The force of attraction between two objects. This may also be referred to as gravitational pull.

GREENHOUSE GASES: Gases in the atmosphere that can **absorb** and emit (or radiate) heat. They include water vapour, **carbon dioxide**, methane, nitrous oxides and ozone.

GROUNDWATER: Underground water supplies that often feed springs and wells.

GULF: A large area of **seawater** partially enclosed by land (usually much bigger than **bays**). Examples include the Gulf of Mexico, the Gulf of Aden and the Gulf of Bothnia.

GULF STREAM: A warm **current** in the North Atlantic that flows northwards from the Gulf of Mexico.

GYRES: These are large systems of rotating ocean **currents**, usually associated with wind-driven **surface currents**. There are five major gyres: in the north Atlantic, the south Atlantic, the north Pacific, the south Pacific and in the Indian Ocean.

HABITAT: The local environment within an **ecosystem** in which an **organism** usually lives. The attractiveness of particular habitats to particular creatures depends on seabed type (sand, mud or rock, for example), factors such as water temperature and **salinity**, and the presence of certain types of marine life, particularly those that form living **reefs**.

HARMFUL ALGAL BLOOMS: Fast-growing algae that can produce toxins which are harmful to other marine **organisms** and humans. These blooms vary in colour (purple, pink, red, green...). Though their exact cause is unknown, some appear to be the result of human activities including pollution and **eutrophication**.

HERBIVORES: Animals that only eat plants, algae and **photosynthesizing** bacteria.

HURRICANE: An extremely intense tropical storm that forms out in the ocean producing very strong winds and heavy rain. In different parts of the world, hurricanes are called **typhoons** or **tropical cyclones**.

HYDROTHERMAL VENTS: Openings on the ocean floor where naturally heated water escapes, often associated with **volcanic** activity.

HYPOXIA: This occurs in ocean environments when the level of dissolved oxygen in **seawater** is reduced so much that it can no longer support marine life. In extreme cases of hypoxia, the area becomes a **dead zone**.

INLAND SEAS: Land-locked bodies of water or salt lakes that show characteristics similar to **seas**.

INVASIVE (ALIEN) SPECIES: Animals, plants and other **species** that have been introduced to an area from somewhere else (either by accident or on purpose), and negatively affect the native **habitat** by successfully competing with native **species** for food.

LARVAE: Animals that have just hatched from their **eggs**. The **larvae** of many marine animals (including crabs, **molluscs** and worms) look very different to their final adult form.

LATITUDE: A measure of the distance north or south of the equator.

MARINE PROTECTED AREA (MPA): A protected area in the marine environment in which some or all human activities are restricted to help protect marine **habitats** and cultural or historical resources found there.

MARINE RESOURCES: Useful things provided by the ocean, including fish, minerals, building materials or even the opportunity for recreation.

MARINE SNOW: Dead bodies and plant or animal waste that fall from the upper ocean to the deep sea.

MIGRATE: To travel a long distance on a regular basis (e.g. whales migrate from feeding grounds in the Arctic to breeding grounds in the Caribbean).

MOLLUSCS: Animals without a backbone ('invertebrates') including snails, squids and octopus. About 23 percent of all named marine **organisms** are molluscs.

MONSOON: The period of heavy rain that occurs in summer in certain tropical and subtropical areas. The monsoon is caused by seasonal winds blowing from the cool sea onto the warm land.

NATURAL RESOURCES: Natural resources are useful materials found in the natural environment around us. Water, soil, wood or rocks are examples of natural resources we rely on to survive. We need water for drinking, water and soil for growing food, wood for making paper and furniture and wood and rocks for building materials. And those are only a few of the uses we can put those resources to! Can you think of more?

NEAP TIDES: Neap tides are **tides** with a less extreme **tidal range** than **spring tides**. They occur when the Moon is in its first or third quarter.

NUTRIENTS: Chemicals which animals and plants need to live and grow.

OCEAN ACIDIFICATION: The increased acidity (or decreased **pH**) observed in the ocean as a result of its rapid uptake in **carbon dioxide** over the last century.

OMNIVORES: Animals that eat both plant and animal material to satisfy their nutritional needs.

ORGANISM: A living creature, like a plant, animal or microorganism.

OVERFISHING: To decrease fish **stocks** by too much fishing.

pH: A measure of how acid (low pH) or alkaline (high pH) a substance is.

PHOTOSYNTHESIS: A biological process found in plants and algae. Photosynthesis uses light as an energy source to convert **carbon dioxide** and water into a source of food (sugars and other useful chemicals).

PHYTOPLANKTON: Small, microscopic marine **organisms** that drift with the ocean **currents**. They live in the upper layers of the ocean and use **photosynthesis** to produce food.

PRIMARY PRODUCERS: **Organisms** that can **photosynthesize** (i.e. plants and algae). Primary producers are the basis for all marine **food chains**.

QUOTA: A limit to something, in this case, the maximum amount of fish that a fisher is allowed to catch. Fishing quotas are officially enforced in order to protect fish **stocks** from **overfishing**.

REEF: A solid underwater structure that may be formed from rock, by marine creatures (such as corals or oysters), or deliberately or accidentally by humans (e.g. harbour pilings or sunken ships).

RENEWABLE ENERGY: Energy powered by renewable resources which can be replaced or replenished, either by natural processes or human action. Wind, water and solar energy are examples of renewable forms of energy.

RIP CURRENTS: These are narrow, fast moving flows of water that travel away from the coast. They can occur at any beach where waves break.

SALINITY: The amount of salt dissolved within **seawater** (its 'concentration').

SEAFARERS: People who work at **sea**.

SEAMOUNT: An underwater mountain that does not break through the surface of the **sea**.

SEA: A large body of saltwater connected to an ocean. Often the word 'sea' is used interchangeably with the word 'ocean'.

SEAWATER: The water found in an ocean or **sea**. It differs from **fresh water** because of the concentration of dissolved salts found in it.

SPECIES: A group of similar **organisms** which are able to breed together and produce healthy offspring that are able to produce young themselves.

SPERM: Male reproductive cells, which are required to fertilize **eggs** to create young.

SPRING TIDES: **Tides** that produce higher high **tides** and lower low **tides** than average and occur when the Moon is new or full (in its second or fourth quarter).

STOCK: The available amount of something (here: the amount of fish available in the ocean).

STORM SURGES: Caused by high winds, storm surges cause a rise in **seawater** resulting in higher-than-usual **tides** that may flood the coast.

STRAITS: Narrow channels of water that connects two larger bodies of water, for example the Straits of Gibraltar (which connect the Mediterranean Sea with the Atlantic Ocean) or the Bering Straits between Alaska and Siberia (which connect the Pacific Ocean with the Arctic Ocean).

SURFACE CURRENTS: Wind-driven **currents** that form in the top 400 m of the ocean surface.

SUSTAINABILITY: The state in which we humans use the natural environment to meet our needs without damaging it so that it can no longer be productive (no longer support plant, animal and human life). Making sure that our actions are sustainable means that future generations will be able to live well, too.

SUSTAINABLY SOURCED: This refers to products that are produced with environmental and social impacts in mind. For example, sustainably sourced fish is caught or raised using methods that do not exploit the ocean environment, fishers or fish farmers, or threaten fish **stocks**.

TEMPERATE: The areas between the **tropics** and the polar regions where the temperatures are relatively moderate with few extremes in winter and summer.

TIDAL BARRAGE: A dam built across an **estuary** to control the flow of the **tide**, using the **tide** to drive turbines which generate electricity.

TIDAL RANGE: The difference between the highest and lowest **tides** in an area.

TIDES: The rise and fall of the sea due to the gravitational pull of the Moon and Sun and the turning of the Earth. Most places see two high and low tides per day. See **gravity**.

TROPICS: The areas around the equator, which have a very warm **climate** and about 12 hours of daylight (and 12 hours of darkness) throughout the year. The **tropics** extend north to the Tropic of

Cancer (the line on which the Sun is directly overhead at noon on 21 June) and south to the Tropic of Capricorn (the line on which the Sun is directly overhead at noon on 21 December).

TROPICAL CYCLONE: See **hurricane**.

TSUNAMIS: These may be extremely powerful waves caused by changes on the seabed including **earthquakes**, **volcanic** eruptions and underwater landslides.

TYPHOON: See **hurricane**.

VOLCANO: A place (usually a mountain) over a break in the Earth's crust, through which molten rock, ash and gas are sometimes expelled. The process of expelling molten rock is called a volcanic eruption.

WATER CYCLE: The water cycle describes the movement of water from the **sea** to the atmosphere to the land and back to the **sea**. It also describes the changes in state of the water from solid to liquid to vapour.

WEATHER: The outdoor conditions experienced on an hour-by-hour or day-to-day basis in a particular place, including the cloud cover, rainfall, air temperature, air pressure, wind and humidity (the amount of water vapour in the air).

ZOOPLANKTON: Microscopic marine animals that float with the ocean **currents**. Some zooplankton spend all of their lives as plankton, but others only spend their young stage as plankton, developing into larger adult phases (e.g. jellyfish and other fish **species**).

JOHN MICHAEL P. JETIGAN, aged 18, PHILIPPINES

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The illustrations in this booklet are a selection from the almost 1 000 submissions received in the 2013 International Drawing Competition, 'Protecting our Fisheries – Inheriting a Healthier World'. See our Web site (www.yunga-un.org) or register to our free mailing list (email yunga@fao.org) to find out about current competitions and activities.


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Previous page: PAUL KEVIN F. PERALTA, aged 18, PHILIPPINES

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http://ioc.unesco.org

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The purpose of the United Nations challenge badges is to raise awareness, educate and, most of all, motivate young people to change their behaviour and be active agents of change in their local communities. Challenge badges are appropriate for use with school classes and youth groups, and are endorsed by WAGGGS and WOSM. They include a wide range of activities and ideas that can easily be adapted by teachers or leaders. Additional badges are available or are being developed on a number of other topics, including: Agriculture, Biodiversity, Climate Change, Energy, Forests, Governance, Hunger, Nutrition, Soils and Water.

The Ocean Challenge Badge is designed to help educate children and young people about the vital role the ocean plays in supporting life on Earth. The badge looks at how people live by, explore and use the coast, the seas and marine products, describing the effect this has on the marine environment and offering ideas on how individuals can take action to help make this close relationship more sustainable.

FOR MORE INFORMATION ON THIS AND OTHER MATERIALS CONTACT:

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