



*Sea Change Teaching Module:  
The Ocean is planet Earth's life support system*

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# 1. Background Information

The ocean makes planet Earth a habitable place to live and the marine environment is a source of vital human health benefits. Some of the invaluable benefits and services the ocean provides include:

**Food:** Seafood is a major food staple and protein source.

**Transportation:** 90% of all EU external trade is transported by sea and European ship owners control almost 40% of the world fleet.

**Recreation:** The benefits that can be derived from spending time around the ocean are intangible. Marine tourism is the second most valuable world marine industry after shipping and transport.

**Medicine:** Biomedical products derived from marine plants and animals provide important medicinal products and health benefits.

**Climate Regulation:** The ocean plays a key role in climate regulation - especially in buffering the effects of increasing levels of greenhouse gases, such as carbon dioxide, in the atmosphere and by moderating rising global temperatures.

**Economy:** Ocean-related industries provide revenue through fishing, seafood distribution, tourism, recreation and transportation. According to the EU Blue Growth programme, the 'blue' economy in Europe represents 5.4 million jobs and generates a gross added value of almost €500 billion a year, with further growth possible.

The ocean is vitally important to Europe. The 28 Member States have between them the largest maritime territory in the world (approximately 3.9 million km<sup>2</sup>) and all of us depend on the ocean and its resources. Despite the importance of Europe's sea areas, their sustainable development and protection faces threats from natural and human pressures. By better understanding the relationships between ourselves and the ocean, we will be better able to protect these precious resources.

## 1.1. Ocean Literacy

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

An ocean-literate person:

- understands the Essential Principles and Fundamental Concepts about the ocean;
- can communicate about the ocean in a meaningful way; and

- is able to make informed and responsible decisions regarding the ocean and its resources

### **The Seven Principles of Ocean Literacy**

1. The Earth has one big ocean with many features.
2. The ocean and life in the ocean shape the features of Earth.
3. The ocean is a major influence on weather and climate.
4. The ocean made Earth habitable.
5. The ocean supports a great diversity of life and ecosystems.
6. The ocean and humans are inextricably interconnected.
7. The ocean is largely unexplored

### **1.2. Oceans & Human Health**

Humans have altered - and will continue to alter - their environment, while remaining dependent upon marine ecosystems as sources of food, water and materials. Human populations are both moving to, and growing in coastal areas globally. Consequently, there is an increased reliance on, and use of, these coastal resources, ranging from fishing and aquaculture activities to desalination for drinking water and recreational use of beaches and coastal areas. Increasing our knowledge of the connections between human health and the ocean has many public health applications, ultimately allowing us to:

- improve our understanding of the potential public health benefits from marine and coastal ecosystems;
- reduce the burden of human disease linked with marine environmental causes; and
- anticipate new threats to public health before they become serious.

#### **What do we mean by ‘ocean & human health’?**

There is increasing recognition that the health of the ocean is inextricably linked to human health and wellbeing. In other words, the marine environment impacts human health in a number of ways. These impacts are a complex mixture of negative influences (e.g. from extreme weather events such as cyclones to water-borne illnesses and pollution) and beneficial factors (e.g. from natural products including seafood to marine renewable energy and wellbeing from interactions with coastal environments). Humans also impact the ocean in a number of ways. Through our activities, including pollution and overfishing, as well as global climate change, we are directly and indirectly affecting the health of the ocean. This in turn has

significant implications for human health, particularly if future potential medicines from the seas, as well as important sources of protein in seafood, are lost due to contamination as a result of human activity and the effects of climate change. Considering these factors together, the study of human health and the ocean is the study of all the ways in which the ocean influences our health and wellbeing, and in turn, how we influence the health of the ocean.

## 2. The ocean is planet Earth's life support system

### **Background Information**

The ocean plays a fundamental role in supporting life on Earth by regulating our climate. It does this by storing and transporting huge amounts of heat, water and greenhouse gases (such as carbon dioxide). By absorbing heat as well as large amounts of carbon dioxide, the ocean lessens the effects of climate change experienced on land. Climate change refers to long-term changes in the Earth's climate as a result of increased concentrations of atmospheric greenhouse gases through human activities, which is warming the planet. Current impacts of climate change include sea level rise, decreasing amounts of snow and ice and changes in rainfall patterns and growing seasons as well as increased occurrences of extreme weather events. However, climate change comes at a cost to ocean health and therefore human health. We can reduce the stress we put on the ocean and limit further climate change by decreasing our carbon footprint (a measure of environmental impact in units of carbon dioxide).

### **The ocean as climate regulator & climate change buffer**

- Ocean currents redistribute heat around the globe. For example, winters in Northwest Europe are 5°C warmer than they would otherwise be because of the Gulf Stream, an ocean current in the Atlantic that draws warm tropical water northwards. Without currents, regional temperatures would be more extreme, i.e. extremely hot at the equator and frigid toward the poles with the result that much less of Earth's land would be habitable.
- Almost all rain that falls on land comes from water evaporated from the ocean. This water helps support all life on land, and we store it to provide drinking water and irrigate crops.
- The ocean currently plays a critical role in reducing the effects of climate change by acting as a buffer. With a volume of 252 billion billion gallons of water, the ocean acts as

a vast store of heat, absorbing about 90% of the additional heat as a result of global warming and about 30% of human emissions of carbon dioxide.

### **Your role as responsible citizens: reduce your carbon footprint**

You can help to protect the ocean, planet Earth's life support system. Some tips below can help you identify how to do it:

**Travel:** Use public transport, walk or cycle instead of driving. When you do need to use a car, try to car share.

**At Home:** Turn down the heating, use energy efficient light bulbs and take shorter showers.

**At school or at work:** Turn off electrical items (e.g. lights and computers) before you go home.

### **Climate change affects marine life**

- Increases in water temperature of just 1-2°C can cause coral reefs to become severely stressed, leading to death if thermal stress is prolonged, thereby endangering coral reef ecosystems.
- Marine species may respond to ocean warming by altering their geographic ranges. Temperature change has been linked to geographic range extension and contractions in diverse marine animal and plant species, such as seaweeds, invertebrates and fish. For example, in the Northeast Atlantic, some plankton are moving northwards at a rate of 200-250 km per decade. As a result, the distribution of fish and other animals that feed on them may also change.
- Carbon dioxide reacts with seawater to raise acidity (ocean acidification) and reduces the availability of calcium carbonate for plants and animals to make calcium-based shells, reefs and exoskeletons (outer body coverings). This could have severe consequences for many marine organisms such as coral, clams, mussels, sea urchins, barnacles, and some microscopic plankton.

### **Climate change impacts on the ocean also impact human health**

- Changes in the distribution of marine life mean that the fish and shellfish we eat could become more abundant in some parts of the world, and less so in others, with profound

impacts to commercial fisheries.

- Warming sea temperatures can lead to an increase in the growth rate of marine pathogens (disease-causing microorganisms). Within Europe, there is concern that the bacteria *Vibrio vulnificus* and *Vibrio parahaemolyticus*, a leading cause of seafood-associated illness, may represent an increasing clinical problem as a result of increasing water temperatures.
- The impact of changing ocean conditions on weather patterns also has consequences for food crops grown on land through changes to rainfall patterns, growing seasons and the occurrence of extreme weather events such as drought. This can lead to food shortages and increased food prices.
- Other impacts of changing ocean conditions include changes in the frequency and severity of tropical storms, which have major consequences for human wellbeing. At the coast, increases in sea level, caused by thermal expansion of sea water, and melting ice caps, could have major consequences for coastal cities through increased risk of flooding (Sea Change, 2015).

### 3. Teacher's Notes

There are several threats to the Earth and the ocean. Therefore it is important to teach the younger generations about these issues. There is also an opportunity for teachers to incorporate the United Nations sustainable development goals while working on this teaching module: Climate action and Life below water. Make the pupils aware that the work they do on climate change and marine biodiversity is of real importance, as shown in the United Nations sustainability goals for 2020 (they are part of the global picture), and that a sustainable ocean is of importance to our societal economies.

We would like to show that together we can help to protect the ocean by teaching and learning about the the planet Earth as a life support system. The activities proposed in this pack focus on:

1. Climate Change
2. Marine Biodiversity

The aim is to help pupils understand the links between the ocean as planet Earth's life support system and human health. The activities can be adapted to teaching pupils aged 6-14, and align with the following Ocean Literacy Essential Principles:

*OLP #1: The Earth has one big ocean with many features.*

The activities provide the opportunity for pupils to understand various parts of the ocean environment and promote the understanding of interconnectedness among different geographic locations.

*OLP #5: The ocean supports a great diversity of life and ecosystems.*

The activities bring aquatic life into the classroom making the pupils better understand marine biodiversity within different ecosystems.

*OLP #6: The ocean and humans are inextricably interconnected.*

Studying climate change and biodiversity enhances perspectives about human impacts on marine ecosystems.

Keywords: Ocean Literacy, climate change, acid ocean, biodiversity, Quick Response

#### Learning Outcomes

- Recognise that the ocean is important to humankind
- Explain that the ocean provides many services
- Identify how the ocean is affected by climate change
- Recognise that humans have altered the marine environment, sometimes harmfully
- Explain carbon dioxide and greenhouse gases
- Identify carbon footprints and describe how one may lower the carbon footprint
- Identify and use key vocabulary associated with climate change and biodiversity
- Identify what types of marine organisms live under the surface of marine ecoregions
- Use Quick Response (QR) codes to present results
- Use Collective Intelligence method to facilitate consultations in the classroom

## 4. Resources & Activities

### 4.1. Activity 1: Climate change

Aim: This activity aims to understand how important the ocean is and what the consequences of climate change are for the ocean, marine organisms and humans. The pupils will get a chance to measure their own carbon footprint and identify actions that can lower their footprint. Older pupils may work in a virtual lab, investigating ocean acidification. Two other exercises investigate carbon dioxide and its impact.

#### Lesson Plan:

##### **Step 1. Introduce the ocean**

Start the activity by asking the pupils to share their knowledge on the ocean and discuss the importance of the ocean. How do they feel about the ocean? What are their experiences? Most questions in this activity can be asked using (a short-version) of the Collective Intelligence methodology (CI) (Appendix 1).

Show a movie (<https://www.youtube.com/watch?v=kz9mknz1ISw>) from the Sea for Society project. How do they feel about the ocean now?

For younger children, show the following videos: Blue society animated series (see Appendix 2; animated series are available in different languages). How do they feel about the ocean now?

Point out that the ocean covers 71 % of the Earth's surface and influences our weather. Mention that humans can get both goods and services from marine ecosystems, such as food and energy. This is called "ecosystem services": can the pupils come up with more examples?

We know how much of the ocean that covers the Earth but a lot of the ocean (95 %) remains unexplored. What does that mean? What difference does it make whether we know or do not know more about the ocean? (Read more on the National Oceanic and Atmospheric Administration ([NOOA](https://www.noaa.gov)) website<sup>1</sup>).

Ask pupils: what do you think we will use the ocean for in the future (completely new things or improvements of existing activities)?

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<sup>1</sup> <http://oceanexplorer.noaa.gov/backmatter/whatisexploration.html>

## **Step 2. Introduce climate change**

The climate has changed before. What's so special now? Discuss in the classroom.

Ask pupils and discuss: what is climate change? What are the most visible signs of climate change? Can climate change harm marine organisms? What can we do to stop climate change? People live by the ocean: the coastal areas are at risk from effect of climate change. What are the impacts of climate change?

How does the ocean respond to climate change? How does this affect the marine organisms?

Too much atmospheric carbon dioxide will have a negative impact on the ocean. What is atmospheric carbon dioxide? Talk to pupils about greenhouse gases. What would happen if there were no greenhouse gases? The Earth would be a frozen planet.

What is a carbon footprint? What is "my" carbon footprint? Also discuss what can each and one of us do to reduce our carbon footprint.

## **Step 3. Investigate climate change**

The pupils can investigate their own carbon footprint using a carbon calculator:

<http://web.stanford.edu/group/inquiry2insight/cgi-bin/i2sea-r2b/i2s.php?page=fpcalc#>

The pupils can investigate ocean acidification (for older pupils and is available in Spanish, Portuguese, German, French and English):

<http://i2sea.stanford.edu/AcidOcean/AcidOcean.htm>

<http://www.virtualmarinescientist.com>

### **Hands-on resources (What is carbon dioxide?):**

Pupils will investigate carbon dioxide gas, as they are blowing up a balloon. They will experience that the sodium bicarbonate will react with the vinegar to create carbon dioxide. Pupils will also experience that carbon dioxide does not smell and does not have a colour. Explain to the pupils that carbon dioxide exists in the atmosphere and is vital to life on Earth. Also explain that carbon dioxide is produced as a waste product (e.g. burning of fossil fuel) (Brieseman, 2013).

### **Hands-on resources (Breathe in...breathe out...):**

Pupils will investigate what happens when water changes from neutral to acidic. When we

breathe, we take in oxygen and breathe out carbon dioxide. This experiment will see the pupils adding carbon dioxide into a glass of water by blowing through a straw. What will happen, is that some of the carbon dioxide bubbles dissolves in the water. Explain to the pupils that some of the dissolved carbon dioxide creates carbonic acid (a weak acid) (Brieseman, 2013).

Materials (What is carbon dioxide?) (Brieseman, 2013).

- Small glass bottle
- Vinegar
- Funnel
- 1 tablespoon baking soda (sodium bicarbonate)
- Balloon
- Tray

Protocol:

1. Put vinegar in a bottle
2. Use a funnel, add the sodium bicarbonate to the balloon
3. Stretch the neck of the balloon over the bottle and lift the balloon so the sodium bicarbonate falls into the vinegar
4. The balloon inflates

Materials (Breathe in...breathe out...) (Brieseman, 2013).

- Two clear plastic cups
- A straw
- Bromothymol blue pH indicator
- Water
- Balloon
- Tray

Protocol:

1. Half fill each cup with water
2. Add a few drops of Bromothymol blue to each cup
3. Place a straw into one cup and gently blow bubbles into the water. In less than a

minute, the water will change colour to a green or pale yellow

4. Compare the two cups of water

### **Carbon footprint calculator – Activity Log Sheet**

1. How does the carbon footprint calculator calculate the results?
2. How can you effect your results (lower them)?
3. What will you do in real life to lower your impact?

### **Ocean Acidification (Urchin larvae experiment) – Experiment Log Sheet**

1. How much has the ocean pH changed since 1800? What will it look like 2100?
2. How can you determine what will happen to organisms if the carbon dioxide levels continue to rise and the ocean gets more acidic?
3. Can you formulate any hypotheses to test how acidification might impact the sea urchins larval stage?

### **What is carbon dioxide? – Experiment Log Sheet**

1. Describe the chemical reaction happening
2. What (and why) are the substances left in the glass?

### **Breathe in...breathe out... – Experiment Log Sheet**

1. Describe the chemical reaction happening
2. Discuss: how much of the air you exhale is carbon dioxide?

## **4.2. Activity 2: Marine biodiversity**

### **Aim**

This activity aims to introduce pupils to marine biodiversity and how it differs in different regions. This exercise will also make use of an Information and Communication Technology (ICT) tool to introduce an element of fun in presenting results.

### **Lesson Plan**

#### **Step 1 Introduce marine biodiversity**

Ask pupils: what lives under the ocean surface?

Do any of the pupils know what is meant by marine biodiversity? Explain what is meant by “marine biodiversity” or “marine biological diversity” and that it concerns the diversity of living organisms in the oceans. Ask the pupils: Why is marine biodiversity important?

Explain why we need to protect our marine biodiversity (the individual species collectively make up the ecosystem) and use it sustainably. Ask if the pupils can explain the concept sustainability.

What are the threats to marine biodiversity (Read more on the CoCoNet website: <http://coconet-fp7.eu/children/TeachersBoi.html>)? And why is it a threat to humans?

#### **Step 2. Investigate marine biodiversity**

The teacher introduces marine ecoregions of the World (MEOW, download pdf on <https://www.worldwildlife.org/publications/marine-ecoregions-of-the-world-a-bioregionalization-of-coastal-and-shelf-areas>). Divide the pupils in smaller groups – divide some of the marine ecoregions of the World among the groups.

Pupils will investigate their marine ecoregion using resources (internet, mobile phones, etc.) available. They will answer questions (see activity log sheet) and record answers as video presentation(s) (if possible) and present it through Quick Response (QR) codes.

The teacher places a large map on the wall (showing regional marine ecoregions of the World). QR codes are printed out and placed in each region.

Pupils will take turns scanning QR codes on the ocean map to learn about their classmates regional ecosystems. Discuss: what were the differences between the regional ecosystems?

## Materials

- Internet
- Mobile phone(s)
- Computer/iPad
- Dropbox account (for the class)
- Printer
- Map
- QR code reader (downloaded application)
- Sticky tape

## Protocol

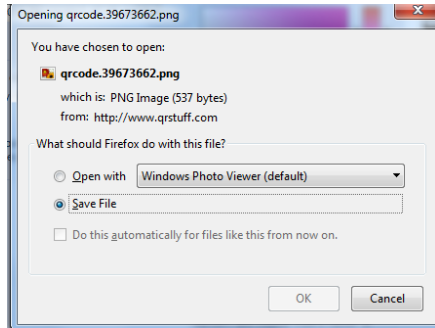
1. Pupils makes a short video presentation
2. Pupils will send their video to the teacher, who will then upload (via computer/iPad) it on a Dropbox account (belonging to the class) [www.dropbox.com](http://www.dropbox.com) (it's free to have a basic account).
3. Go to “camera uploads” in Dropbox, select movie and “share”, “create a link”, “copy” the link.
4. Go to <http://www.qrstuff.com/> (it's free to use) and paste the link in the box (marked yellow):

The screenshot shows the 'QR CODE GENERATOR' interface. Step 1, 'DATA TYPE', has radio buttons for 'Website URL' (selected), 'YouTube Video', 'Image File', and 'PDF File'. Step 2, 'CONTENT', has a 'Website URL' field with the text 'http://' followed by a yellowed-out area. Below the content field is an 'Encoding Options' section.

5. Press “Download QR code” (marked in yellow)

The screenshot shows the 'QR CODE GENERATOR' interface with three steps. Step 3, 'FOREGROUND COLOUR', features a color selection tool with a rainbow gradient and a 'Foreground Colour (Hex):' field containing '000000'. To the right is a 'QR CODE PREVIEW' section showing a QR code. Below the QR code is a yellowed-out 'DOWNLOAD QR CODE' button.

6. Save or open the file:



7. Here's the QR code!



8. Print out the QR codes and place (using sticky tape) it on a map
9. The pupils, with a (free) QR code reader installed in their mobile phones, will take turns to scan the map and receive the presentations on their own phones.
10. The class discusses the results

### Step 3. Cross-border collaboration

For teachers interested in collaborating across borders and a hands-on pedagogical project, sign up to join the VIRTUE project.

- a number of CDs are mounted on a rack and placed in different underwater environments during different seasons.
- Analysing the growth of organisms (biofouling) on discs and registering the findings in a database or on paper enables the pupils to compare and discuss their results.
- The project manager has a number of Swedish schools (middle and high school) eager to make contact with other schools.
- Topics that could be discussed cross-border:
  - biodiversity
  - climate change
  - ocean pollution

- future/survival of the oceans and its sustainability
- Contact the project manager ([virtue@science.gu.se](mailto:virtue@science.gu.se)):



### **Investigate marine biodiversity – Activity Log Sheet**

- Investigate your marine ecoregion: how many species can be found? (Pupils can use the cards provided in Appendix 3).
- How many of the marine species are found only in your marine ecoregion?
- How much of the Earth's surface is covered by your regional marine ecosystem?
- How much (percentage) does your marine ecoregion account for in terms of the world's oceans and seas?

## 5. Additional Information and Further Reading

Australian Government Great Barrier Reef Marine Park Authority (2016) Impacts of Climate Change on Corals. Available at: <http://www.gbrmpa.gov.au/managing-the-reef/threats-to-the-reef/climate-change/what-does-this-mean-for-species/corals>

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Climate challenge game from BBC:

[http://www.bbc.co.uk/sn/hottopics/climatechange/climate\\_challenge/aboutgame.shtml](http://www.bbc.co.uk/sn/hottopics/climatechange/climate_challenge/aboutgame.shtml)

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## **Further Reading**

### **What is Sea Change?**

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

*Sea Change* will create a deeper understanding of how the health of European citizens depends on the health of our ocean, and how the health of our ocean depends on the actions of our citizens.

For more information on the project, and ways in which you can get involved, please visit <http://www.seachangeproject.eu/http://www.seachangeproject.eu/>.

### ***Ocean Literacy for Empowered Citizens***

Most European citizens are not aware of the full extent of the medical, economic, social, political and environmental importance of the Ocean to Europe and indeed to the rest of the world. Many of us are not aware of how our day-to-day actions can have a cumulative effect on the health of the Ocean – a necessary resource that must be protected for all life on the planet Earth to exist. In other words, European citizens lack a sense of “Ocean Literacy” - an understanding of the ocean’s influence on us and our influence on the Ocean. AN OCEAN-LITERATE PERSON: - Understands the importance of the ocean to humankind - Can communicate about the ocean in a meaningful way - Is able to make informed and responsible decisions regarding the ocean and its resources.

## 6. Appendices

### Appendix 1. Collective Intelligence methodology (short-version)

#### Material:

- white/black board
- pencils
- A4-sheets (white and yellow)
- Post-it notes (small)

#### Protocol:

1. Arrange tables to be in U-seating (if possible).
2. The teacher will ask a trigger question (e.g. what do we use the Ocean for today/in the future?)? The trigger question will be written on a white/black board.
3. The pupils will have 5 minutes to write short (or make drawings) answers (on a white A4 sheet) to the trigger question. They will select on question and write this on a yellow 4 sheet and put this up on the wall. All pupils will explain their answers.
4. Give all pupils three small post-it notes (nothing should be written on the post-its). Ask them to place them on the answers that they liked the most (they are allowed to place more than one post-it on an answer).
5. The teacher identifies the most “popular” answers. Applauds all round.

## Appendix 2. Blue Society Animated Series

### Episode 1: The Ocean & Oxygen



- [English version](#)
- [French version](#)
- [Greek version](#)
- [Italian version](#)
- [Polish version](#)
- [Portuguese version](#)
- [Spanish version](#)
- [Swedish version](#)
- [Dutch version](#)
- [Norwegian version](#)
- [Hebrew version](#)

### Episode 2: The Ocean & Fresh water



- [English version](#)
- [French version](#)
- [Greek version](#)
- [Italian version](#)
- [Polish version](#)
- [Portuguese version](#)
- [Spanish version](#)
- [Swedish version](#)
- [Dutch version](#)
- [Norwegian version](#)
- [Hebrew version](#)

### Episode 3: The Ocean & Food



- [English version](#)
- [French version](#)
- [Greek version](#)
- [Italian version](#)
- [Polish version](#)
- [Portuguese version](#)
- [Spanish version](#)

- [Swedish version](#)
- [Dutch version](#)
- [Norwegian version](#)
- [Hebrew version](#)

#### Episode 4: The Ocean & Leisure



- [English version](#)
- [French version](#)
- [Greek version](#)
- [Italian version](#)
- [Polish version](#)
- [Portuguese version](#)
- [Spanish version](#)
- [Swedish version](#)
- [Dutch version](#)
- [Norwegian version](#)
- [Hebrew version](#)

#### Episode 5: The Ocean & Manufactured Goods



- [English version](#)
- [French version](#)
- [Greek version](#)
- [Italian version](#)
- [Polish version](#)
- [Portuguese version](#)
- [Spanish version](#)
- [Swedish version](#)
- [Dutch version](#)
- [Norwegian version](#)
- [Hebrew version](#)



#### Episode 6: The Ocean & Culture

- [English version](#)
- [French version](#)
- [Greek version](#)
- [Italian version](#)
- [Polish version](#)
- [Portuguese version](#)

- [Spanish version](#)
- [Swedish version](#)
- [Dutch version](#)
- [Norwegian version](#)
- [Hebrew version](#)

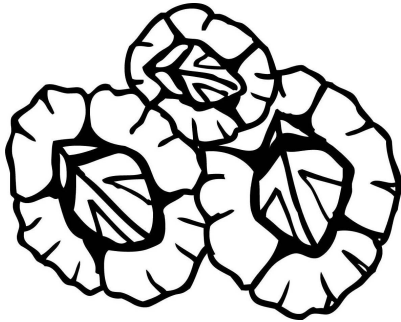
### **Episode 7: The Ocean & Communication**



- [English version](#)
- [French version](#)
- [Greek version](#)
- [Italian version](#)
- [Polish version](#)
- [Portuguese version](#)
- [Spanish version](#)
- [Swedish version](#)
- [Dutch version](#)
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### **Appendix 3. Marine Biodiversity Printable cards**

Cards for use in food biodiversity activities. Print, fold (so the clue is on the back) and cut-out to use.



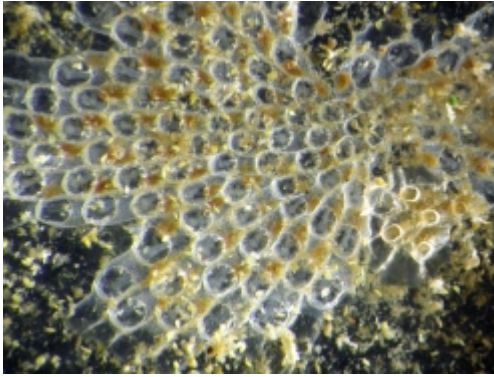
**Barnacle**

Barnacles attach to hard surfaces and use their legs to catch tiny particles of food, including plankton from the water around them.



**Sea squirts**

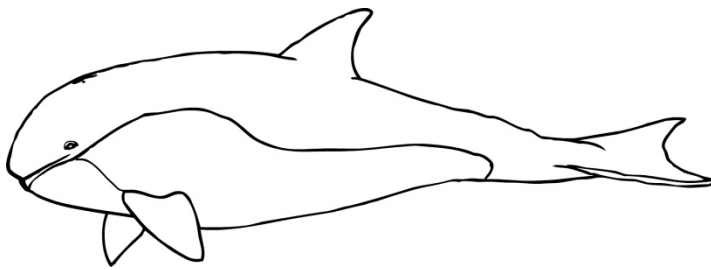
Sea squirts are sessile animals and growing individually (solitary) or forming colonies. The body resembles a sack and has a protective cover, called the mantle. Sea squirts are filter feeders and usually hermaphroditic but many can also reproduce asexually. As larvae they are small and free swimming.



**Moss animals**

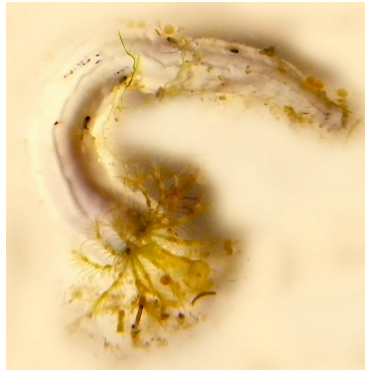
(Photo: Anders Larsson)

Bryozoans are a separate group that forms colonies, like corals, and often occurs on worm or mussel shells, stones, rocks, sand grains or seaweed. Moss animals eat different types of single-celled algae, with the help of a ring of tentacles around the mouth.



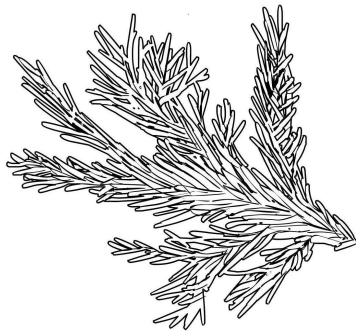
**Harbour porpoise**

The harbour porpoise hunts for small fish like sand eels using sound.



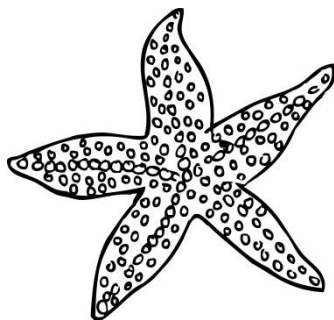
Marine bristle worms  
(Photo: Mikael Olsson)

Tubeworms are a group of marine bristle worms (Polychaeta), that live in tubes built by themselves. These tubes can be constructed of mucus mixed with stone and sand and glued to various surfaces. They can also be calcific and permanently attached on for example mussels and large brown algae.



Green seaweed

Green seaweed uses energy from the sun and lives attached to hard surfaces.



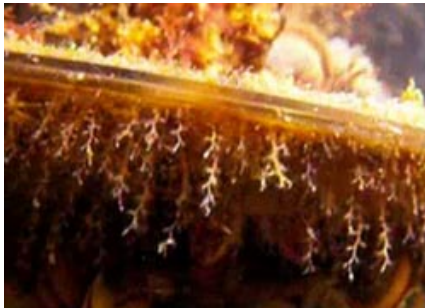
Common starfish

Starfish eat animals such as mussels by prizing open their shells with their strong arms.



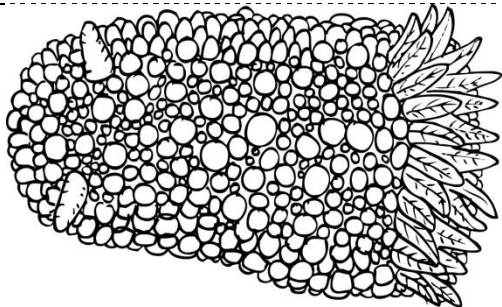
Sea anemone  
(Photo: Mikael Olsson)

Anemones are typically a polyp with stinging cells in their tentacles. The stinging cells paralyze and capture prey, which is then moved with the aid of tentacles to the mouth and melted in a central body cavity. Anemones have a "base plate" that it uses to attach itself to rocks or similar surfaces.



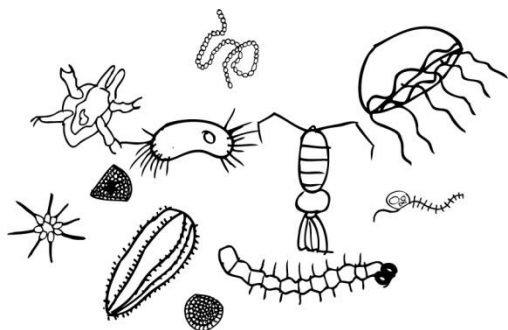
Hydroids  
(Photo: Mikael Olsson)

Most hydroids live in colonies where many individuals work together. The colony consists of genetically identical individuals, called polyps. The colonies may look different and be constructed in very different ways, which means that hydroids can be very different from each other. Therefore, it is difficult to determine the species. Hydroids can sit on shells, stones and seaweed.



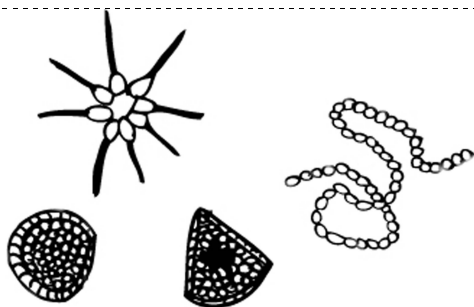
Sea slug (*Onchidoris bilamellata*)

This sea slug is specially adapted to feed exclusively on barnacles.



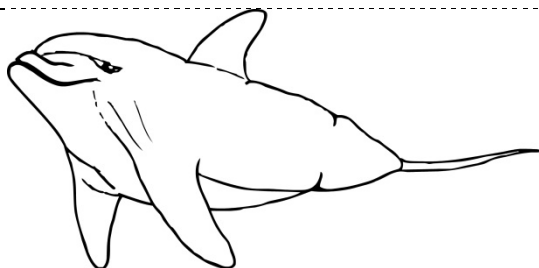
**Zooplankton**

Zooplankton are animals which are transported around on ocean currents. They may be the larvae of larger animals including fish, crabs and snails, or may always be plankton. They usually feed on phytoplankton or other species of zooplankton.



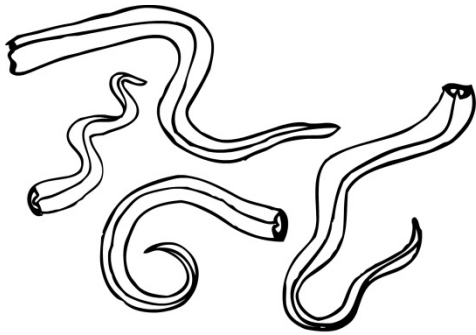
**Phytoplankton**

Phytoplankton are tiny plants, which are transported on ocean currents. They obtain energy from sunlight.



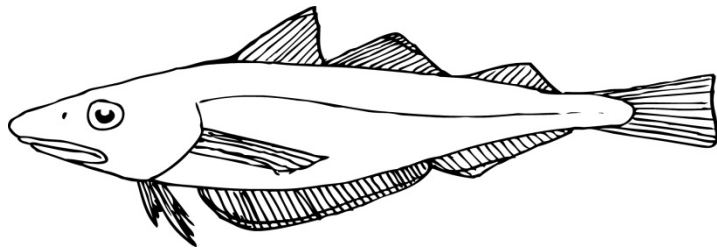
**Bottlenose dolphin**

The bottlenose dolphin uses sound to hunt for medium to large fish like whiting.



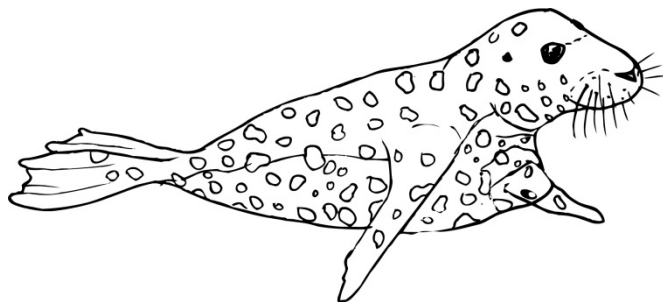
**Keel worm**

Keel worms live permanently attached to hard surfaces catching and eating food passing in the water, including plankton.



**Whiting**

The whiting hunts for small animals including fish like sand eels, crustaceans like crabs, worms and bivalves like mussels and clams.



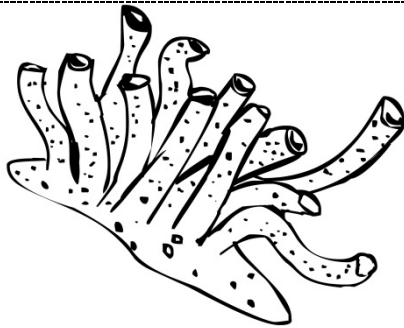
**Grey seal**

The grey seal dives below the surface to hunt for fish like whiting and large crustaceans (crabs and lobsters).



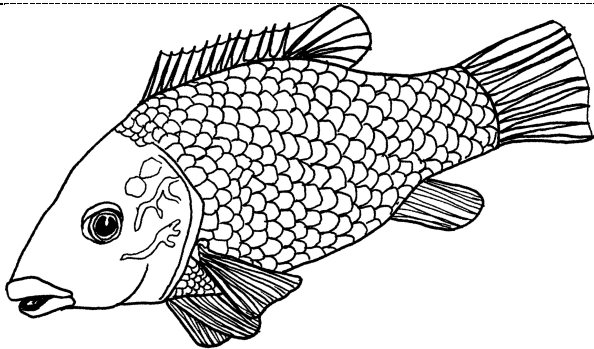
The compass jellyfish uses its stinging tentacles to capture small animals like sand eels floating past in the water.

**Compass jellyfish**



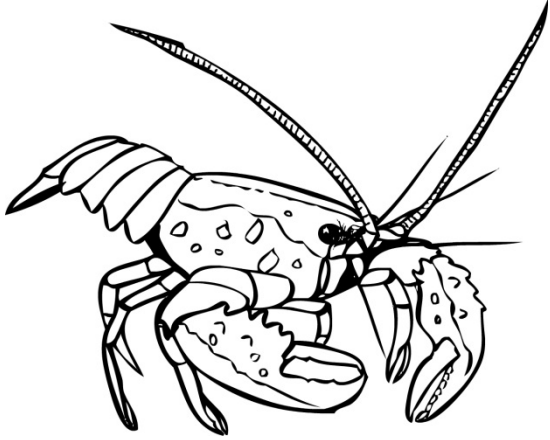
Ross worms make protective tubes from sand and eat plankton and particles of dead plants and animals from the water around them.

**Ross worm**



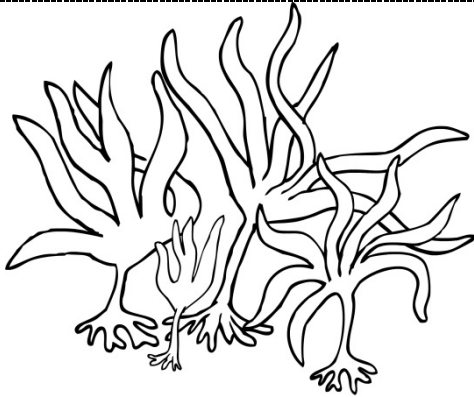
Wrasse have strong teeth to crush and eat small, shelled animals (e.g. hermit crab).

**Wrasse**



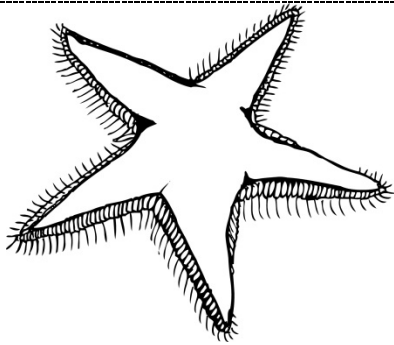
**Common Lobster**

Lobsters use their strong claws to crush the shells of the animals they feed on including clams, mussels, and crabs.



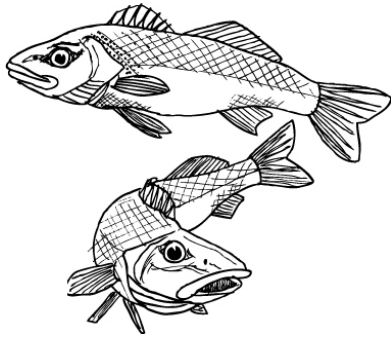
**Oarweed**

Oarweed is a large seaweed that lives at or just below the low tide mark. It uses energy directly from the sun.



**Sand star**

Sand stars are active predators and hunt for clams and other small animals buried under the sand.



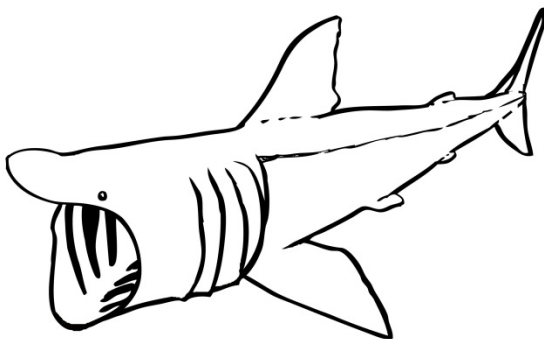
Bass

Bass actively hunt for small fish like sand eels and other small animals like crabs.



Conger eel

Conger eels eat a range of smaller fish and invertebrates such as crabs and bivalves (e.g. mussels and clams).



Basking shark

The basking shark swims through the water with its mouth wide open, sieving plankton to eat.



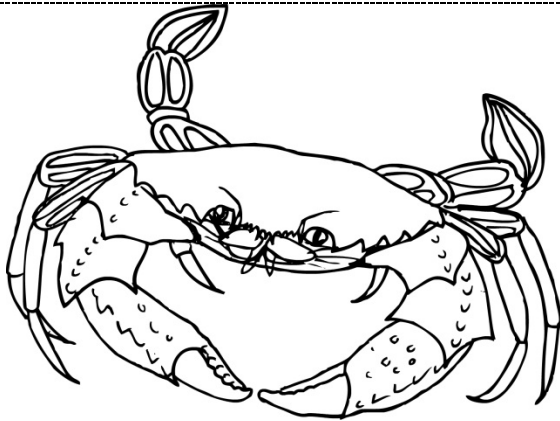
**Common mussel**

Mussels use strong threads to attach themselves to hard surfaces and filter food from the water around them, including plankton.



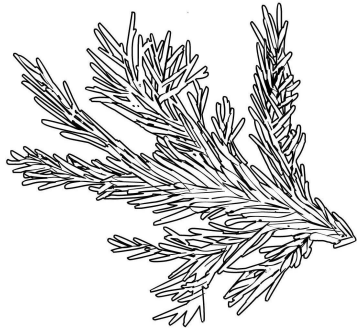
**Sand eel**

Sand eels hunt for small animals including zooplankton.



**Velvet swimming crab**

Velvet swimming crabs are active predators and use their sharp claws to tear apart small animals like mussels and small crabs and break their shells.



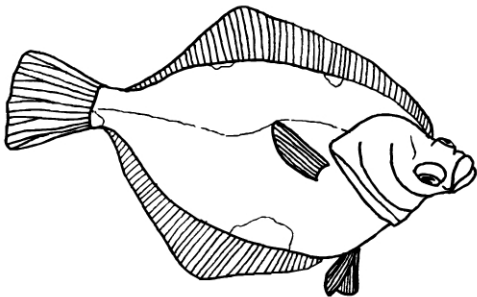
**Green seaweed**

Green seaweed uses energy from the sun and live attached to hard surfaces.



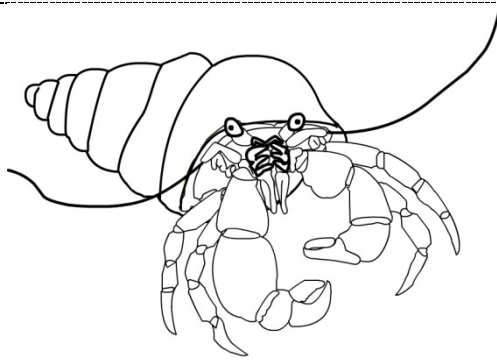
**Edible crab**

Edible crabs use their powerful claws to crush the shells of their prey. They eat a variety of small animals, like mussels and other small crabs, and seaweed.



**Plaice**

Plaice lie hidden on the seabed ready to ambush small animals such as shrimps and smaller fish like sand eels. They also eat worms and bivalves like clams.



**Hermit crab**

Hermit crabs are scavengers and eat dead plants and animals on the seabed. They even use the shells of dead snails to protect their own soft bodies.