The Big Blue Ocean Cleanup's objective is to offer a Key Stage 2-Key Stage 3 curriculum unit to provide children with an understanding of how ocean pollution impacts on the natural world and inspire them to do something about it.

This will be achieved in 4 topics.

1. **Seabirds**
2. **Oceans and Currents**
3. **Pollution Analysis**
4. **Looking to the future**

Each topic aims to provide a basic understanding around the title theme, as well as outlining key points and how they are linked.

The lesson plans are designed to have the video presented at the start of the lesson. These videos raise the key points that will consequently be further developed within the teaching material provided, to give an overall contextual understanding. Each lesson will also contain various suggested activities that can be included/adapted/excluded from the lesson as you deem necessary.

The lesson plans are also colour coded to hopefully make it simple for you to follow:

Grey – The video narrative – the information raised within the videos**.**

Black – Teaching Information – extra information to explain the points raised in the video and give them context. This is the information to be relayed to the children in the way you see fit. NOTE: Some concepts are complicated and although it has been simplified as much as possible, we do understand the teaching information may not be fully suitable for younger KS2 classes, therefore please adapt as necessary. We hoped by providing you with all the information, we could give you the understanding and enable you to choose what information would be most important for your class.

Green – Key point summaries – The key points highlighted by the section of teaching information/activity. If no other extra information is retained by the students, then it is hoped they will be able to retain the key points. These key points are linked and as a minimum should allow the students to follow the lesson context from the start to finish.

Blue –Activity/Class Question: Our suggested activities/ class questions. Please adapt as you feel necessary.

***Key words and definitions**. Will be presented in a box.*

Topic Two: Ocean and Currents

Video 2: https://www.bigblueoceancleanup.org/education-programme

The video summarises key points regarding oceans currents and plastic pollution. The lesson should develop knowledge around these key points and help students understand how the key points are linked to one another.

Start glossary of key words and their definitions, throughout lesson add to as necessary.
-Key words will outlined in italics and a separate box, with a corresponding definition.

NOTE: This topic might be better split into 2 parts and covered in 2 lessons. It is a fairly complicated concept and might be better to take it slowly and focus on part 1 and part 2 in two separate lessons. Parts one and two will be indicated below.

Overall Learning Objectives:

PART 1

1. **Learn about different ocean currents: Surface Currents, Deep water currents and Gyres.**
2. **Understand how Gyres trap marine plastic and create ocean garbage patches.**

PART 2

3. **To learn about the different ways plastic enters the food chain and is eaten by marine animals.**
4. **To understand that all marine animals are now threatened by plastic because it enters the food chain in many different ways.**

PART 1

Video information:

Approximately 70% of the earth's surface is covered by water. This is made up of rivers, lakes, glaciers but mainly the world's oceans: **the Arctic, Atlantic, Indian, Pacific and Southern Oceans.** These cover vast areas and can be found in different parts of the world.

They are connected and water and anything in it can be moved around the world by gyres, large systems of ocean currents which spiral about a central point. This means that plastic waste deposited in coastal areas, as well as that dumped illegally at sea, can be moved further out to sea, ending up in the large areas of calm water in the centre of the gyre. These are called garbage patches as plastic and other waste becomes trapped, breaking down into smaller and smaller pieces. These tiny plastic particles are as small as the algae and plankton that form the basis of the entire food chain.

Teaching information. * NOTE: fairly complex concept, information provided below covers all aspects and is as simple as possible but please reiterate/adapt/edit as necessary depending on teaching group capabilities*

The worlds oceans are in fact one body of water, all connected by currents. As a result, water can be transported across the world and through all the different oceans by these currents.

Currents are made up of both surface currents and deep ocean currents:

- Deep ocean currents are caused by differences in the temperature and saltiness of the ocean water. In cold areas such as the Arctic and Antarctic, ocean water is cooled, loosing heat to the surrounding atmosphere/air. When this water becomes very cold it becomes heavy, sinking to the seafloor. Deep sea water movement then transports this deep water across the globe.

Deep Ocean currents *- Deep sea water movement then transports this deep water across the globe.*

- Surface currents on the other hand are affected by wind and storms. These currents are responsible for moving the warm water found around the equator towards the polar areas. They transport warmth, a good example of this is the current known as the gulf stream. The gulf stream keeps Britain warm, it originates near Mexico and moves the warmer water across the Atlantic towards Europe, increasing the temperature and climate of the UK.

Surface Ocean currents *- move the warm water found around the equator towards the polar areas.*

The movement of some currents can be affected by the spin of the earth and any land masses that surround them. This creates something known as a gyre: a circulating body of water. Think about how water drains out of a sink when you let the plug out, it spins in a circle. This is similar to how gyres work, the earth spinning, causes the ocean water to spin and when it meets a land mass, it deflects (alters its course), then continues travelling until it meets another and so on. A fairly complicated concept. Water continues to spin until it reaches the middle of the gyre. In the middle of the gyre the rotation slows and stops, creating a calm body of water in the centre. Each ocean has a gyre in its north and south

hemisphere. Gyres pick up plastic in the ocean and move it to the centre, where it becomes trapped in the calm water and creates what we call an ocean garbage patch.

Gyre: *a circulating body of water, with faster moving water at the outside of the circle and calmer moving water at the centre.*

Key Points to be made from teaching information: Surface currents can move water at the surface of the ocean. Deep water currents can move water at the bottom of the ocean. Gyres circulate water. Gyres are important with regards to marine plastics. This circulating water picks up plastic and transports it. It moves to the calm water in the middle of the gyre and becomes trapped. As a result the amount of plastic builds and builds, creating what we call an ocean garbage patch.

PART 2

***If split into two lessons, replay video 2:**

Video 2: https://www.bigblueoceancleanup.org/education-programme

Summarise what was learnt last lesson and what will be learnt this lesson:

Overall Learning Objectives:

PART 1

1. **Learn about different ocean currents: Surface Currents, Deep water currents and Gyres.**
2. **Understand how Gyres trap marine plastic and create ocean garbage patches.**

PART 2

3. **To learn about the different ways plastic enters the food chain and is eaten by marine animals.**
4. **To understand that all marine animals are now threatened by plastic because it enters the food chain in many different ways.**

Teaching Information:

Now plastics are commonly used for a huge variety of different things: This is due to their diversity and their hardiness- the fact they don't disappear over long periods of time:

***Plastic diversity**: A wide variety of characteristics: shapes, sizes, colours and textures. (For example, the differences between a bucket and spade, a plastic bag, cling film and a plastic bottle)*

However they do break up into smaller fragments. Once trapped in ocean gyres plastic they are subject to many natural processes: wind and weathering, sun exposure and wave action. These processes cause plastic to break up over time into smaller and smaller pieces, but never

actually disappearing. These big bits of plastic breaking into small pieces is what creates microplastics in our oceans.

Key point: When trapped in gyres, plastic breaks down into smaller and smaller fragments due to:

- Wind
- Weather
- Sun exposure
- Waves

Class question: Microplastics are what size, can you remember from last lesson?
Answer: Less than 5mm in size

Video information

These tiny plastic fragments are about the same size as plankton and algae in the ocean that are hugely important as they form the basis of the entire food chain. In the ocean tiny plant-like microbes called phytoplankton are eaten by zooplankton, which are in turn eaten by animals such as krill, sponges, and corals. Other animals then feed on these, forming what we call a food chain. In the case of the albatross the chain goes like this: Phytoplankton are eaten by zooplankton, which are eaten by small fish, which are in turn eaten by squid, which are finally eaten by the albatross.

Class question (if it has been covered before in science lessons) What is a food chain?
Answer: A food chain shows how organisms are related to each other as a result of the food they eat.

Teaching information

An example of an ocean food chain:

Phytoplankton -> Zooplankton -> Krill/Shrimp -> Fish -> Whales/Sharks

The fragmented plastic, known as microplastics are as small as the algae and plankton that forms the bottom of the food chains. Food chains show us the different ways animals can accidentally eat marine plastic.

For the wandering albatross its food chain goes as such:

Phytoplankton -> Zooplankton -> Small fish -> Squid -> Albatross

If activity below is too complicated, don't worry. Exclude and skip to focus on the key point summarised below.

Activity 2: In pairs or groups, can you think of different ways animals in this food chain could accidentally eat plastic. And think of how the wandering albatross might therefore be at risk of eating plastic.

Answers you could cover:

1. Zooplankton might mistake microplastic fragments for phytoplankton because a lot of microplastic fragments are the same size. They mistake the microplastic for their food. This is a direct way that microplastic is ingested. Mistaken Microplastic -> Zooplankton

2. Small fish might accidentally eat microplastic because larger fragments of microplastic are a similar size to the zooplankton that they eat. They mistake the microplastic for their food. This is a direct way that microplastic is ingested. Mistaken Microplastic -> Small fish

3. Small fish might also eat zooplankton that has already eaten microplastic. This is an indirect way of ingesting microplastic. (Zooplankton + Ingested Microplastic) -> Small fish

4. Small fish might accidentally eat microplastic that is in the water while trying to eat zooplankton. This is a direct way microplastic is ingested. Zooplankton + Microplastic in water -> Small fish

5. A squid might accidentally eat microplastic that is in the water while trying to eat small fish. This is a direct way microplastic is ingested. Small fish + Microplastic in water -> Squid

6. A squid might eat small fish that have already accidentally eaten microplastic. This is an indirect way of ingesting microplastic. (Small fish + Ingested microplastic) -> Squid

7. The albatross might accidentally eat plastic that is in the water while trying to eat squid. This is a direct way that microplastic is ingested. Squid + Microplastic in water -> Albatross

8. The albatross might eat squid that has already accidentally eaten microplastic This is an indirect way of ingesting microplastic. (Squid + Ingested microplastic) -> Albatross

9. The albatross might mistake macroplastic such a plastic bag for a squid and eat it instead. This is a direct way that microplastic is ingested. Macroplastic eg plastic bag -> Albatross

Key Point from the Albatross Food Chain/ Activity 2: 3 main ways plastic can be eaten by marine animals:

1- Animals mistake microplastic for their food and eat it instead (For example, small fish mistake microplastic for zooplankton which is their normal food and eat the plastic instead. Or the Albatross mistakes a plastic bag for squid and accidentally eats the plastic bag.)

2- Animals eat their food and also eat microplastic that is floating in the water close by (For example, the squid eats small fish and also eats microplastic that is floating close by)

3- Animals eat food that already contains microplastic (For example the albatross eats a squid that has already eaten microplastic)

Video Information:

Unfortunately, this is not the only problem. Seabirds, such as albatrosses, search vast areas of the ocean for food and consume plastic in other ways too. For an albatross searching for food at sea distinguishing food from rubbish might be difficult. A plastic bag might be mistaken for a squid. An albatross might also ingest plastic because food is attached to the rubbish E.g a plastic bottle that is covered with sea life. In particular, flying fish lay nutritious eggs on floating material in the open ocean, including plastic materials. These eggs are a common part of the albatross's diet, so it is easy to understand how they end up eating the plastic too. Plastic has been found in the stomach of almost all marine species, including fish, birds, whales, dolphins, seals, turtles.

Teaching information:

There are so many ways that microplastics and plastics enter the food chain and this is just one small branch of a huge food web. As mentioned in the video, Albatross don't just eat squid, one of their favourite foods is the high nutrient packed eggs of the flying fish. Flying fish lay their eggs on floating material. With large amounts of plastic now floating in the ocean, flying fish will now accidentally lay their eggs on plastic and albatross will accidentally eat it.

Like we mentioned last lesson there are many ways we can help protect our oceans. Managing our waste correctly, recycling as much as we can and reducing the amount of single use plastic we use are al steps that help prevent plastic from reaching our oceans.

Key point from Teaching information and Activity 2 (put into context):

With the small food chain we looked at in Activity 2 we have identified a lot of different ways that plastic might enter it. The ocean environment is made up of hundreds and hundreds of different food chains that are all linked to form something called a food web. Now if one small food chain within the food web has a large number different ways plastic can enter it by being ingested, imagine how many ways plastic could enter the whole food web and how many different ways plastic could be ingested by the animals inside it: The ocean is under threat.

Thank you

Lesson plan material provided by Ellen McArthur, MSci Marine Biology 2019,
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Please do not hesitate to get in contact if you have any questions or queries. I will endeavour to reply as soon as possible. Any feedback will also be greatly appreciated.

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