Encounter Edu

Ocean Plastics

Geography | Ages 11 - 14

Teacher Book

Geographical Association

Common Seas

A resource by Encounter Edu and Common Seas

Digital Explorer CIC T/A Encounter Edu
Edinburgh House LG01
170 Kennington Lane
London, SE11 5DP

Written by Jamie Buchanan-Dunlop
Edited by Megan Folan
Layout and design by Simeon Goodwin

With thanks to

Geographical Association

Common Seas

Common Seas is a not-for-profit enterprise that researches, designs and implements practical project-based solutions to our global plastic pollution crisis. Our mission is to quickly and significantly reduce the amount of plastic waste produced and stop it polluting rivers and seas.

Encounter Edu

Encounter Edu designs and runs STEM and Global Citizenship education programmes, which make use of virtual exchange, live broadcast and virtual reality. These technologies create classroom encounters that widen young people's world view. Learning is further underpinned by an online library of teacher resources and training. Combined, these provide children with the experience and knowledge to develop as engaged citizens and critical thinkers for the 21st Century.

Contents

Welcome to the Ocean Plastics Academy

Common Seas

Marine plastic pollution is a visible and pervasive environmental issue affecting all oceans. Recent media coverage has raised awareness of the topic, encouraging politicians, businesses and the general public to take much-needed action.

Common Seas believes that education can be an important part of the solution to addressing marine plastic pollution. The recent popularity of the topic of marine plastics has meant that there is a wealth of information and ideas for action scattered across the internet and other media.

Common Seas uniquely provides teachers with a full suite of resources across science, geography, and design and technology across Key Stages 1 to 3, that are designed to fulfil the English National Curriculum teaching requirements. Providing teachers with off the shelf lesson plans, presentations and activities they can choose to deliver in their entirety or use sections as appropriate.

Supporting a more sustainable relationship with the environment is not a quick fix, but a multi-generational endeavour. This is why Common Seas works with a range of partners to move marine plastics education from an important side issue into the mainstream.

Jo Royle
Managing Director
Common Seas

About the Ocean Plastics Academy

What is the Ocean Plastics Academy?

Achieving the aim of plastic-free seas is likely to be a multi-generational endeavour. As with any environmental crisis, the important place to start is from a shared understanding of the problem and then move to solutions both in terms of individual behavioural change and advocating for changes at wider scales from the community-level upwards.

Literacy is the starting point for the education programme. A shared understanding of plastics across its entire life cycle including its impact on the marine environment is crucial in developing appropriate responses and informing action on a personal and community level. A plastics literate population will also be able to inform good governance, both as leaders and voters.

However you choose to address the issue of marine plastic pollution in your classroom, it can be hard to know what children should know. Common Seas has used the UNESCO Learning Objectives for the ocean[1] as a basis for creating a set of Ocean Plastics Learning Objectives to support educators in designing an appropriate set of learning opportunities for students. These learning objectives are listed in following section.

Literacy on its own is not enough and Common Seas will also be developing engagement tools that help to shift literacy into action, so do keep in touch!

How do I use the Ocean Plastics Academy?

These resources have been designed to be an off-the-shelf teaching tool for your classroom. Of course, you know your students better than anyone and may want to adapt and change to suit your needs.

You will find a suite of supporting multimedia resources online, and these are referenced throughout the lesson plans. It is assumed that you have access to a digital projector or interactive white board to display these resources and accompanying slideshows. Students with individual devices can also view multimedia without needing an account.

If this is the first time that you are teaching an oceans-related unit to your students, consider using the Ocean for beginners resources (https://encounteredu.com/teachers/units/ocean-plastics-science-ages-11-14) to provide context.

Is the Ocean Plastics Academy curriculum aligned?

Ocean Plastics Academy are aligned to the National Curriculum for England programmes of study for science, geography and design and technology. As the Ocean Plastics Academy develops, we will align the resources to additional curricula and standards.

[1] UNESCO Ocean literacy for all: a toolkit https://unesdoc.unesco.org/ark:/48223/pf0000260721 (see page 24)

Learning objectives

Common Seas has worked with partners to create a set of universal Ocean Plastics Learning Objectives, utilising the frameworks developed by UNESCO and those working for Ocean Literacy. These learning objectives are listed below and are subscribed to by Common Seas Ocean Plastics Academy partners. We hope that these overarching learning objectives are useful to other individuals and organisations planning their own education programming to help a plastic waste free future.

Ocean Plastics 11-14 Geography

Ocean Plastics learning objective	Lessons 1	2	3	4	5	6	7	8	9
Cognitive learning objectives									
• The learner understands the fundamental properties of plastics, including the use of additives.		✓							
• The learner understands the scope and geographical scale of plastic use and plastic pollution historically as well as current predictions.	✓	✓			✓				
• The learner understands the pathways through which plastics enter the ocean and marine life.	✓			✓					
• The learner understands the social, environmental and economic cost of plastics across its entire life cycle.									
• The learner can identify and evaluate ways to improve the sustainability of plastics at different stages of the product life cycle[1].				✓					
Socio-emotional learning objectives									
• The learner can reflect on their own use of plastics, and how this use might affect the marine environment.	✓	✓							
• The learner actively seeks alternative designs, behaviours and practices that reduce their contribution to plastic pollution.			✓	✓					
• The learner can communicate the societal and environmental impacts of plastic use, referring to the scientific evidence base.			✓						
• The learner is able to influence the behaviours and practices of others in their community in terms of plastic use and management.					✓				
• The learner can collaborate at a range of scales to campaign for the reduction of plastic pollution.									
Behavioural learning objectives									
• The learner is able to access and improve waste management systems in their local area.					✓				
• The learner can plan and implement campaigns that lead to a reduction in plastic pollution at a range of scales.					✓				
• The learner is able to evaluate media narratives about plastic pollution and present a balanced judgement to their peers.									
• The learner is able to make informed decisions as a consumer to reduce plastic pollution.						✓			
• The learner is able to research different approaches to design, including circularity and biomimicry.								✓	✓

[1] Including improved design, alternative materials, waste management and individual behaviour.

Applicable standards

National Curriculum for England Key Stage 3

KS3 Geography Element of the curriculum	Lessons 1	2	3	4	5	6	7	8	9
Aims									
• Develop contextual knowledge of the location of globally significant places – both terrestrial and marine – including their defining physical and human characteristics and how these provide a geographical context for understanding the actions of processes	✓								
• Collect, analyse and communicate with a range of data gathered through experiences of fieldwork that deepen their understanding of geographical processes								✓	✓
• Interpret a range of sources of geographical information, including maps, diagrams, globes, aerial photographs and Geographical Information Systems (GIS)		✓	✓			✓	✓		
• Communicate geographical information in a variety of ways, including through maps, numerical and quantitative skills and writing at length			✓			✓	✓		
Locational knowledge									
• Extend their locational knowledge and deepen their spatial awareness of the world's countries using maps of the world to focus on Africa, Russia, Asia (including China and India), and the Middle East, focusing on their environmental regions, including polar and hot deserts, key physical and human characteristics, countries and major cities			✓	✓	✓				
Human and physical geography									
• Physical geography relating to: geological timescales and plate tectonics; rocks, weathering and soils; weather and climate, including the change in climate from the Ice Age to the present; and glaciation, hydrology and coasts	✓								
• Human geography relating to: population and urbanisation; international development; economic activity in the primary, secondary, tertiary and quaternary sectors; and the use of natural resources	✓	✓	✓	✓	✓	✓	✓	✓	✓
• Understand how human and physical processes interact to influence, and change landscapes, environments and the climate; and how human activity relies on effective functioning of natural systems	✓	✓	✓	✓	✓	✓	✓	✓	✓
Geographical skills and framework									
• build on their knowledge of globes, maps and atlases and apply and develop this knowledge routinely in the classroom and in the field	✓		✓	✓	✓				
• use fieldwork in contrasting locations to collect, analyse and draw conclusions from geographical data, using multiple sources of increasingly complex information								✓	✓

Lesson 1: What is the 'Great Pacific Garbage Patch' really like?

Overview

This first lesson in the unit introduces students to the topic of marine plastics. First, they visit the 'Great Pacific Garbage Patch' and find out what is happening in the middle of the ocean. Then, students will develop their knowledge of ocean currents and how they can concentrate plastic waste. Last, students will investigate how rubbish reaches the middle of the ocean.

Learning outcomes

- Reflect on marine plastic pollution
- Describe and locate the 'Great Pacific Garbage Patch'
- Map and investigate ocean gyres
- Describe how plastic accumulates in gyres and is a global phenomenon
- Differentiate between managed and unmanaged plastic and explain its pathway to the ocean

Resources

Slideshow 1:
What is the 'Great Pacific Garbage Patch' really like?

Student Sheet 1a:
The 'Great Pacific Garbage Patch'

Student Sheet 1b:
All about gyres

Student Sheet 1c:
Map the gyres

Video:
NASA Perpetual Ocean

External link:
The Majestic Plastic Bag - A Mockumentary

Lesson 2: What is plastic and why is it a problem in the ocean?

Overview

With plastics being ubiquitous in modern life, students examine what has made this material so popular. Students then learn what happens to litter when it enters the ocean. Finally, the lesson looks at how plastics affect turtles, and whether we have enough information to take drastic action on plastics, or whether we need to wait for more research to be conducted.

Learning outcomes

- Consider how the properties of plastic make it so popular
- Rank how different types of litter biodegrade in the ocean
- Suggest how plastics can harm turtles
- Evaluate whether there is enough scientific evidence to take drastic action on plastics
- Consider how the properties of plastic make it so harmful

Resources

Slideshow 2:
What is plastic and why is it a problem in the ocean?

Student Sheet 2a:
Plastic starters

Student Sheet 2b:
What is plastic and why is it a problem in the ocean?

Student Sheet 2c:
Plastic and turtles

Student Sheet 2d:
Plastic action vote

Lesson 3: Plastic case study - tourism in Kenya

Overview

Plastic does not just have an environmental and health impact, it can also affect economies and communities. For tourism locations, a pristine beach will attract more visitors than one covered in plastic waste. In this lesson, students will look at a tourism case study on Lamu Island off the coast of Kenya.

Learning outcomes

- Assess what makes Lamu a popular tourist destination
- Apply mapping skills to describe key processes
- Evaluate the threat caused to Kenya's economy by plastic waste
- Describe how actions at a range of scales are addressing plastic pollution
- Evaluate the threat caused to Kenya's economy by plastic waste

Resources

Slideshow 3:
Plastic case study - tourism in Kenya

Student Sheet 3a:
Lamu tourism brochure

Student Sheet 3b:
Holiday heaven or paradise lost to plastic?

Student Sheet 3c:
Lamu mapping

Student Sheet 3d:
Flipflopi case study

External Link:
Yes We Can! Shela to Kipungani Beach Cleanup

External Link:
DePollutionizing Shela Beach

Lesson 4: How can we deal with all the plastic waste?

Overview

With plastic production already exceeding 300 million tonnes per year, the mountain of waste has the potential to grow and grow. This lesson looks at whether recycling can be a solution, before examining three different economic models to see if we need to change the way we look at plastic and plastic products. The lesson asks students to consider the impact of managed, unmanaged and mismanaged waste.

Learning outcomes

- Analyse the rapid growth in global plastic production
- Describe the different paths that plastic can take after disposal
- Consider how effective the UK is at recycling
- Decide whether a linear economy is fit for purpose in the 21st century
- Reflect on artistic works showing the plastic problem

Resources

Slideshow 4:
How can we deal with all the plastic waste?

Student Sheet 4a:
Recycling cards

Student Sheet 4b:
A new economy

Student Sheet 4c:
What happens to plastic waste in Asia and Africa?

Thinglink:
Global plastic production

Thinglink:
Life cycle of a plastic bottle

Lesson 5: The global journey of plastic waste

Overview

The UK exports over half a million tonnes of recovered plastic packaging each year. Historically, much of this was to China, but with a ban on waste imports other solutions and destinations have been sought. Students start by mapping the destinations of plastic waste exports before and after China's ban. Then students consider the UK's options, before ranking these and creating a proposal for action.

Learning outcomes

- Map the global destinations of UK recycling over time
- Describe how these destinations have changed over time
- Review information on the current state of UK plastic waste management
- Evaluate options for the future of UK plastic waste management

Resources

Slideshow 5:
The global journey of plastic waste

Student Sheet 5a:
Plastic export maps

Student Sheet 5b:
Waste management futures info

Student Sheet 5c:
Waste management futures pyramid

Student Sheet 5d:
Whose waste is it anyway?

Lesson 6: Approaches to reducing ocean plastic pollution

Overview

Experts agree on the need for urgent action to tackle the issue of marine plastic pollution but disagree on the what methods should be prioritised. Students will look at two main schools of thought: 'turn off the taps', stopping plastic from entering the ocean by reducing plastic pollution, limiting single-use plastic use, improving waste management, and introducing alternative products; and 'bail out the bath', removing plastic waste from the ocean and beaches. Students engage in a silent debate followed by a group discussion to focus on what they believe is the most effective solution.

Learning outcomes

- Understand the human use of natural resources has caused an environmental situation which needs a solution
- Evaluate different solutions to the problems, which work at different scales
- Apply skills of data gathering from a number of sources
- Debate the positive and negative features of each possible solution
- Communicate geographical information through extended writing

Resources

Slideshow 6:
Approaches to reducing ocean plastic pollution

Student Sheet 6a:
How can we rethink plastic to solve the problem of ocean plastics?

Student Sheet 6b:
Plastic bag ban in Kenya

Student Sheet 6c:
The Ocean Cleanup

Student Sheet 6d:
Plastic straws

Student Sheet 6e:
Reusing packaging

Student Sheet 6f:
Beach clean-ups

Student Sheet 6g:
Recycling

Student Sheet 6h:
Reusable alternatives

Lesson 7: Plastic decision making exercise

Overview

Students work through an end of unit assessment that includes short answer questions, data interpretation questions and a decision making exercise. The decision making exercise uses information that students will have gathered during the silent debate in Lesson 6.

Learning outcomes

- Understand the human use of natural resources has caused an environmental situation which needs a solution
- Understand that there are different solutions to the problems, which work at different scales
- Understand that each possible solution has positive and negative features
- Practise skills of data gathering from a number of sources; processing, interpretation, analysis, information communication and extended writing

Resources

Slideshow 7:
Decision making exercise

Student Sheet 7a:
Ocean plastics assessment

Mark scheme 7a:
Ocean plastics assessment

Lesson 8: Plastics fieldwork (school grounds)

Overview

This lesson provides a framework for conducting plastics fieldwork in the school grounds. As per most fieldwork, it consists of three phases: preparation, conducting fieldwork, and then analysis and conclusions. Depending on your school timetable and ability of your class, you will need to set aside three to four hours to complete this fieldwork activity. Suggestions for challenge tasks are included for more able students, if you teach a mixed ability class.

Learning outcomes

- Plan fieldwork including risk assessment
- Plan and carry out data collection
- Represent data using tables, charts and maps
- Analyse fieldwork data and draw conclusions
- Evaluate fieldwork methods and results
- Suggest ways of improving the area in terms of reducing plastic pollution

Resources

Slideshow 8:
Plastic fieldwork (school grounds)

Student Sheet 8a:
Plastics fieldwork record sheet

Student Sheet 8b:
Plastics fieldwork report frame

Student Sheet 8c:
Plastics fieldwork evaluation

Lesson 9: Plastics fieldwork (local area)

Overview

This lesson provides a framework for conducting plastics fieldwork in the local area. As per most fieldwork, it consists of three phases: preparation, conducting fieldwork, and then analysis and conclusions. Depending on your school timetable and ability of your class, you will need to set aside three to four hours to complete this fieldwork activity. Suggestions for challenge tasks are included for more able students, if you teach a mixed ability class.

Learning outcomes

- Plan fieldwork including risk assessment
- Plan and carry out data collection
- Represent data using tables, charts and maps
- Analyse fieldwork data and draw conclusions
- Evaluate fieldwork methods and results
- Suggest ways of improving the area in terms of reducing plastic pollution

Resources

Slideshow 9:
Plastic fieldwork (local area)

Student Sheet 9a:
Plastics fieldwork record sheet

Student Sheet 9b:
Plastics fieldwork report frame

Student Sheet 9c:
Plastics fieldwork evaluation

Teacher guidance

The Teacher Guidance for each lesson uses a set of icons as seen below to provide visual clues to support teachers:

Lesson activities

Explain
teacher exposition using slides or script to support

Demonstration / watch
students watch a demonstration or video

Student activity
activity for students to complete individually such as questions on a Student Sheet

Pair activity
activity for students to complete in pairs

Group work
activity for students to complete in groups

Whole class discussion
teacher conducts a whole class discussion on a topic or as a plenary review

Home learning
home learning exercise for after school or alternatively, a lesson extension

Teacher ideas and guidance

Assessment and feedback
guidance to get the most from AfL (Assessment for Learning)

Guidance
further information on how to run an activity or learning step

Idea
optional idea to extend or differentiate an activity or learning step

Information
background or further information to guide an activity or explanation

Technical
specific ICT or practical hints and tips

Health and safety
health and safety information on a specific activity

Lesson 1:
What is the ‘Great Pacific Garbage Patch’ really like?

Students explore the fabled ‘Great Pacific Garbage Patch’ understanding the human and physical processes that have created it.

Resources in this book:


Lesson Overview 1


Teacher Guidance 1


Student Sheet 1a: The Great Pacific Garbage Patch

Student Sheet 1b: All about gyres

Student Sheet 1c: Map the gyres

Student Sheet 1d: What happened to the rubber ducks?

Resources available online:


Slideshow 1: What is the ‘Great Pacific Garbage Patch’ really like?


Video: NASA Perpetual Ocean

All resources can be downloaded from:
encounteredu.com/teachers/units/ocean-plastics-geography-ages-11-14

LESSON 1

What is the 'Great Pacific Garbage Patch' really like?

Age 11-14

60 minutes

Curriculum links

- Describe and locate the 'Great Pacific Garbage Patch'
- Explain how unmanaged waste reaches the ocean

Resources

Slideshow 1:
What is the 'Great Pacific Garbage Patch' really like?

Student Sheet 1a:
The 'Great Pacific Garbage Patch'

Student Sheet 1b:
All about gyres

Student Sheet 1c:
Map the gyres

Student Sheet 1d:
What happened to the rubber ducks?

Video:
NASA Perpetual Ocean

External link:
The Majestic Plastic Bag - A Mockumentary

Extension or home learning

A home learning exercise can be set using the story of the rubber ducks that have travelled around the world's oceans after a cargo ship lost some from a container over the side.

Lesson overview

This first lesson in the unit introduces students to the topic of marine plastics. First, they visit the 'Great Pacific Garbage Patch' and find out what is happening in the middle of the ocean. Then, students will develop their knowledge of ocean currents and how they can concentrate plastic waste. Last, students will investigate how rubbish reaches the middle of the ocean.

Lesson steps	Learning outcomes
1. Our plastic journey (10 mins) Students start on their journey to understand and tackle the issue of marine plastic pollution by reflecting on what they already know about the topic through the media.	• Reflect on marine plastic pollution
2. 'Garbage Patch' (10 mins) The 'Great Pacific Garbage Patch' has been an emblematic case study for the plastic pollution problem. Students travel to the centre of the Pacific to study the issue.	• Describe and locate the 'Great Pacific Garbage Patch'
3. How do ocean gyres form? (15 mins) The collection of plastics in ocean gyres is caused by rotating ocean currents. Students learn how these currents are formed and how they accumulate plastic.	• Map and investigate ocean gyres • Describe how plastic accumulates in gyres and is a global phenomenon
4. How does plastic enter a gyre (15 mins) Students create a flow chart to show how plastic can reach the ocean and what happens when it gets there.	• Differentiate between managed and unmanaged plastic and explain its pathway to the ocean
5. Wall of plastic (5 mins) Students are invited to write on a post-it note or other format how they feel about the issue of ocean plastics.	• Reflect on marine plastic pollution

TEACHER GUIDANCE 1 (page 1 of 3)
WHAT IS THE 'GREAT PACIFIC GARBAGE PATCH' REALLY LIKE?

Step	Guidance	Resources
1 10 mins	Introduce the topic of ocean plastics, including the scope of the unit as a whole. · Using slides 2-4 explain to students that they will be learning about ocean plastics. · The unit is broken into two separate sections and depending on the time you have allotted, describe how students will begin by learning about the issue of ocean plastics, before an optional fieldwork study. · Students may have an understanding of the ocean plastics topic from the news and television programmes. Assess the level of knowledge and any misconceptions, using a whole class discussion, with slide 5. · Any questions or ideas can be written on post-it notes or on the board to serve as a reference point during the unit.	**Slideshow 1:** Slides 1-5
	To refresh your own subject knowledge, refer to the Ocean Plastics Subject Updates, especially Learn more: Plastics facts and figures and Learn more: Common plastics myths.	**Subject Update:** Learn more: Plastics facts and figures Learn more: Common plastics myth
	If this is the first time that you have taught a marine focused unit with this class, consider using some of the lessons from the Oceans for beginners 11-14 mini-unit.	**Unit:** Oceans for beginners 11-14
2 15 mins	Students' journeys into understanding ocean plastics begins with a visit to the 'Great Pacific Garbage Patch'. First noted in 1997 by sailor Charles Moore, the Garbage Patch has become emblematic of the ocean plastics issue. · Explain to students that they are starting the topic of ocean plastics by visiting the middle of the Pacific Ocean. Use a map or globe to show the location. · Hand out Student Sheet 1a and showing slide 7, ask students to sketch what they think the Garbage Patch looks like. · This should be a quick sketch to give an impression and not a complete work of art! · Review the sketches with a mini-plenary and showing slides 8-10, ask students which they think most closely resembles the 'Great Pacific Garbage Patch'. Slide 9 is in fact the closest and taken from the centre of the Garbage Patch.	**Slideshow 1:** Slides 6-15 **Student Sheet 1a:** The 'Great Pacific Garbage Patch' **Subject Update:** Learn more: The 'Great Pacific Garbage Patch'

Step	Guidance	Resources
	· Support students to complete the written answer questions using information on slides 11 and 12 or the information on the Subject Update Learn more: The 'Great Pacific Garbage Patch'. · Emphasise the scale of the overall ocean plastics issue to complete this section of the lesson using slides 13-15.	
	A common misconception is that the 'Great Pacific Garbage Patch' is a huge floating island of plastic. In fact, it more closely resembles a plastic soup of smaller particles, interspersed with larger plastic items. Discarded fishing nets can collect other plastic waste, creating small 'islands'. If all the plastic were collected in an island, cleaning the Pacific of plastic would be a much simpler task.	
3 15 mins	Step 3 invites students to consider how plastic reaches the ocean. · Review the different types of plastic waste in the ocean using slide 17. Explain briefly how each type of plastic waste could reach the ocean. · You can show your class a fun 'mockumentary' charting the course of a plastic bag from being thrown away to reaching the ocean. · Students are then challenged to create a flowchart showing how plastic can reach the sea. They can work in groups and select any of the examples show. Slide 19 shows students the different flowchart blocks to use and slide 20 show an example of the start of a flow chart on slide 21, with a full completed version on slide 22 that can be used to review the activity.	**Slideshow 1:** Slides 16-21 **External Link:** The Majestic Plastic Bag - A Mockumentary
	For more information see Learn more: Sources of marine plastic pollution.	**Subject Update:** Learn more: Sources of marine plastic pollution
	The Majestic Plastic Bag - (https://youtu.be/GLgh9h2ePYw) is on YouTube and you may need to contact your IT department to ensure that YouTube videos are viewable in your class.	

TEACHER GUIDANCE 1 (page 3 of 3)
WHAT IS THE 'GREAT PACIFIC GARBAGE PATCH' REALLY LIKE?

Step	Guidance	Resources
4 15 mins	Step 4 introduces students to how ocean currents can accumulate plastic in gyres. The main point to get across here is that the ocean is in constant motion and is not the equivalent of a big swimming pool. · Use the animation by NASA Perpetual Ocean to show students a model of the system of ocean currents. · Use slides 24-26 go over the key points for students to know about ocean currents. · Students then complete the questions on Student Sheet 1b, using slides 27-28 to support this. · Student Sheet 1c provides an extension activity to research and locate the main gyres. This lesson step mentions the term 'gyre'. This describes the five main rotating currents across the world's oceans. A working definition is 'a gyre is a large rotating ocean current'. It is not essential that students understand fully the drivers for ocean currents. You may wish to give a brief overview of how wind causes friction that moves surface waters; how land masses can force waters to move in a different direction; and, finally, how different densities of water drive a larger current system known as the ocean conveyor. For the last point, you can find an in-depth explainer in the Subject Update Learn more: Ocean circulation.	**Slideshow 1:** Slides 22-28 **Student Sheet 1b:** All about gyres **Student Sheet 1c:** Map the gyres **Video:** NASA Perpetual Ocean **Subject Update:** Learn more: Ocean circulation
5 5 mins	The issue of ocean plastics is thought-provoking and emotional. End this first lesson by asking students how they feel about the issue and gather thoughts and ideas on post-it notes or on the board.	**Slideshow 1:** Slides 29
+ 20 mins	Students plot the journeys of 28,000 Friendly Floatees bath toys which were lost at sea. This could be plotted on the completed gyre map or on a second blank map. The bath toys journey demonstrates a greater interconnectivity between the oceans than previously thought. Plastic from anywhere in the world, once it has entered the ocean, may be transported thousands of miles from its source. Scientists calculate that the North Pacific is the greatest attractor of plastic particles. A small video clip from the Blue Planet II Episode 4 (19 minutes to 22 minutes) which shows a re-enactment of the incident. This episode is available on BBC iPlayer for UK residents at https://www.bbc.co.uk/ iplayer/episode/ b09g5ks6/blue-planet-ii-series-1-4-bigblue	

The Great Pacific Garbage Patch

The 'Great Pacific Garbage Patch' is located in the North Pacific Ocean to the west of California between latitudes 35° north and 42° north and longitudes 135° west and 155° west. Study the ways some people have described it and draw a sketch to show how you think it might look according to the statements.

"An island twce the size of Texas!"	"79,000 tonnes of debris floating"	"3 times the size of France"
"Plastic going around in circles trapped forever"	"How do you convey when you wake up on day four and you're still seeing this plastic pouring past the boat?"	"The world's biggest landfill - except that it's in the ocean"

1. Study the picture of the real 'garbage patch'. How accurate do you think these statements are?

.....

.....

.....

.....

2. Make a bullet point list of at least four accurate facts about ocean 'garbage patches'.

- .....
- .....
- .....
- .....

3. Summarise with one short sentence what an ocean 'garbage patch' is like.

.....

.....

.....

.....

STUDENT SHEET 1b

All about gyres

1. Think about how ocean currents are formed and how they can then create gyres. Join the beginnings of the sentences in the table below to the correct end of the sentence.

Beginnings...	Endings.
The ocean is...	are primarily driven by wind.
Both at the surface and at depth the ocean currents...	an ocean gyre forms.
Ocean currents...	the position of land masses.
When wind blows across the surface of the water...	in constant motion.
A second factor impacting the ocean currents is...	it creates friction, causing the water to move.
They are also affected by differences in...	and accumulate in gyres.
When the wind and land create a large circular motion...	water density and the Earth's rotation.
Plastics entering the sea can be carried by ocean currents...	move vast volumes of water every day.

2. The development of the North Pacific Gyre

Either:

Read and complete the following sentences to describe the formation of the North Pacific Gyre.

Or:

Using the map, describe how the North Pacific Gyre is formed.

The Coriolis effect means that the trade winds cause the tropical water to move westwards as the _ _ _ _ _ _ _ _ _ _ _ _ Current.

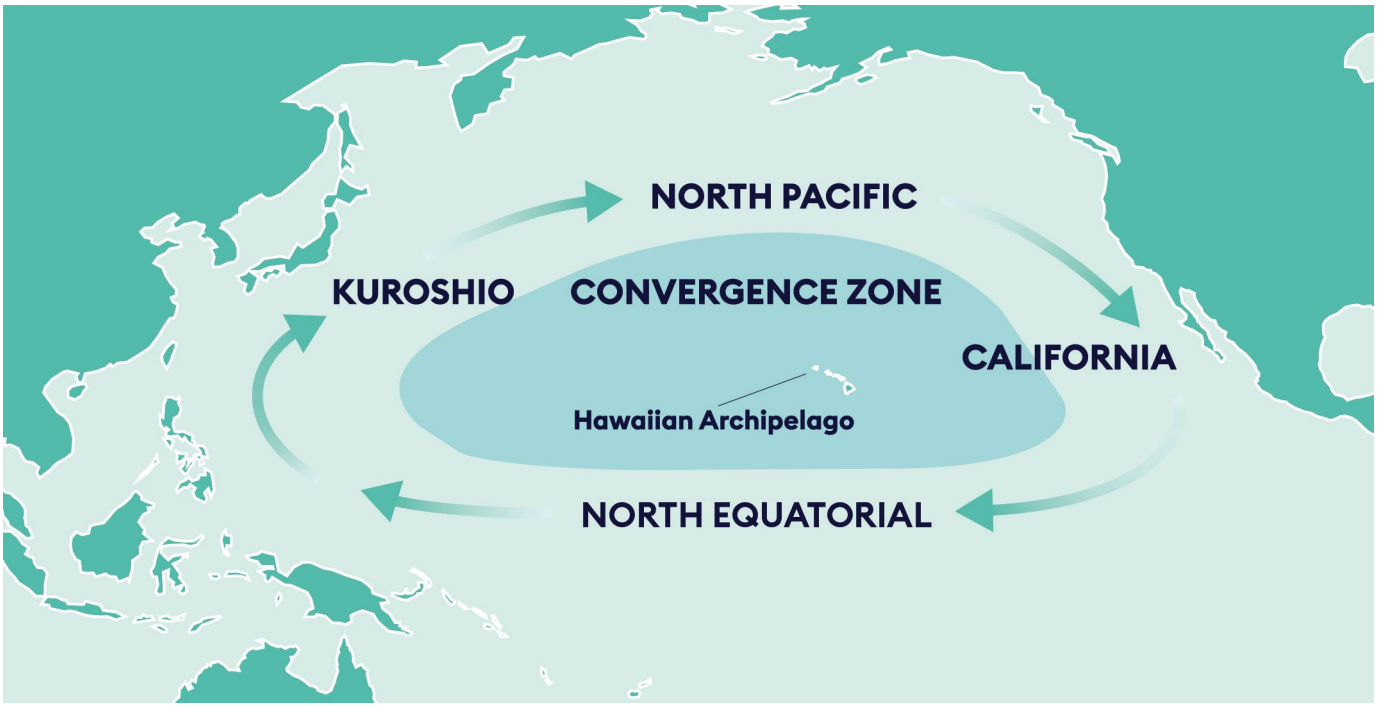
Debris usually stays in the gyre but may wash up on coasts when there are storms.

Westerly winds change the direction of the current towards the east as the _ _ _ _ _ _ _ _ _ _ _ _ Current.

Again, blocked by land the ocean current is forced south towards the Equator as the _ _ _ _ _ _ _ _ _ _ _ _ Current.

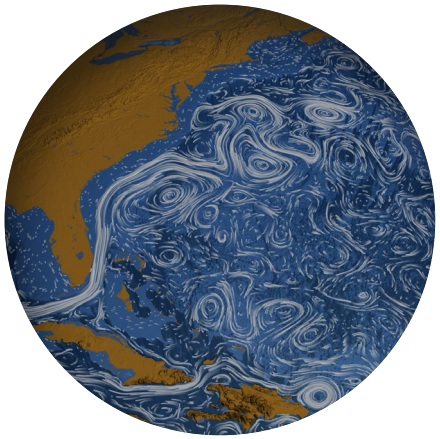
When the North Equatorial current reaches the Asian land mass it is forced to move north as the _ _ _ _ _ _ _ _ Current.

The circular movement of the water sweeps any plastic debris with it. One circulation may take ten years.

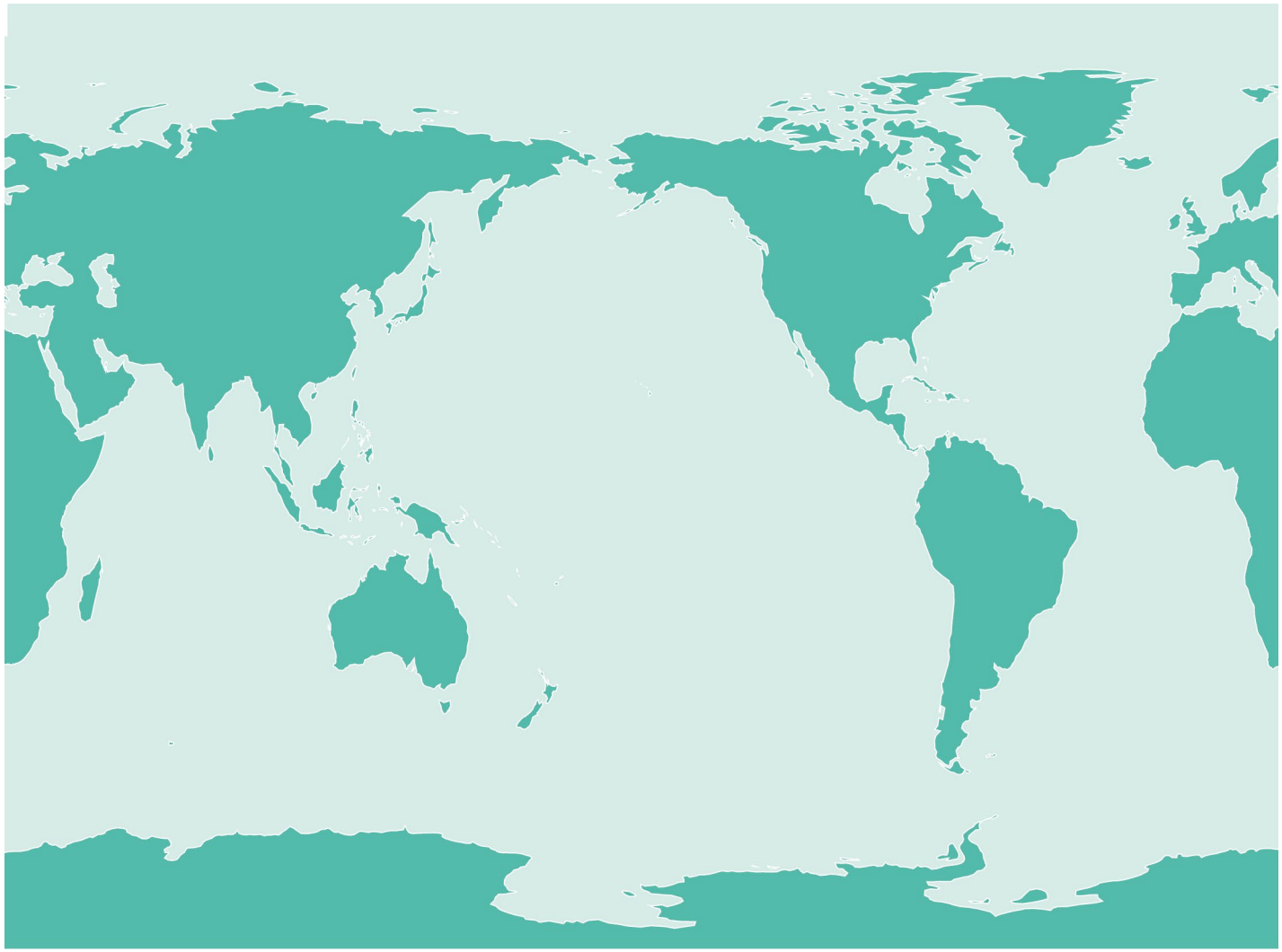


Map: The North Pacific Gyre or Convergence Zone

Map the gyres



Draw the five main gyres onto the map, name them and give their latitudes and longitudes.



What happened to the rubber ducks?

The story of the rubber ducks

In 1992, a shipping container of 28,000 plastic bath toys fell overboard on its way from Hong Kong to the United States. Carried by ocean currents, over 20 years later, they are still being washed ashore, on Hawaii, Alaska, South America, Australia and the Pacific Northwest. They are found frozen in Arctic ice, and washed up in Scotland and Newfoundland in the Atlantic. Scientists have learned a lot about ocean currents and plastic accumulation in gyres from studying them.

2,000 toys still circulate in the North Pacific and Subpolar Gyres, taking about three years to complete a circuit between Japan, south east Alaska, the Kodiak and the Aleutian Islands.

6th Jan 1992	The Ever Laurel sails from Hong Kong.
Jan 1992	At 45°N and 178°E in the Pacific Ocean 28,000 plastic bath toys spilled from the ship.
1992	10,000 toys move north and some enter the Subpolar and North Pacific gyres. 18,000 toys move south washing up in Indonesia, Australia and South America
Nov 1992	Ducks begin landing on the shores of Alaska
Early 1995	Ducks circle in the gyre for three years to Japan then back along the north west Pacific coast and east, landing again in North America. Some ducks landed in Hawaii, more in Alaska.
1995-2000	Some toys escape the gyre and move north, through the Bering Strait. Some become frozen in the Arctic ice and some ducks travel east across the pole.
1996	Ducks are found on the Washington State and Canadian west coasts.
2000	Ducks thaw and reach the North Atlantic, then move south. Ducks found between Maine and Massachusetts.
2001	Ducks are found at 42°N 50°W, where thew Titanic sank.
2003	One green frog is found in the Hebrides in north-west Scotland.
2007	A single duck is found in Cornwall.

STUDENT SHEET 1d

1. On the map, mark the sites where the animals have landed or been sighted.

2. Draw arrows to show the path of their journeys, including the circulation pattern.
3. Have the ducks remained in the North Pacific convergence zone ('Great Pacific Garbage Patch')?

.....

4. Where did the ducks first wash ashore?

.....

5. Why do you think this was the case?

.....

.....

6. Describe the route the ducks took to arrive on the coasts around the Atlantic.

.....

.....

7. What does this route tell us about the connectivity of the oceans?

.....

.....

8. What do these journeys suggest about the origin of a piece of plastic found in any ocean and the distance it could have travelled?

.....

.....

Lesson 2:
What is plastic and why is it a problem in the ocean?

Students investigate what plastic are and a range of the environmental impacts caused by plastics in the ocean.

Resources in this book:

Lesson Overview 2

Teacher Guidance 2

Student Sheet 2a: Plastic starters

Student Sheet 2b: What is plastic and why is it a problem in the ocean?

Student Sheet 2c: Plastics and turtles

Student Sheet 2d: Plastics action vote

Resources available online:

Slideshow 2: What is plastic and why is it a problem in the ocean?

All resources can be downloaded from:
encounteredu.com/teachers/units/ocean-plastics-geography-ages-11-14

LESSON 2

What is plastic and why is it a problem in the ocean?

Age 11-14

60 minutes

Curriculum links

- Analyse why plastic can be a problem in the ocean
- Evaluate the level of harm caused to marine life by plastic

Resources

Slideshow 2:
What is plastic and why is it a problem in the ocean?

Student Sheet 2a:
Plastic starters

Student Sheet 2b:
What is plastic and why is it a problem in the ocean?

Student Sheet 2c:
Plastic and turtles

Student Sheet 2d:
Plastic action vote

Lesson overview

With plastics being ubiquitous in modern life, students examine what has made this material so popular. Students then learn what happens to litter when it enters the ocean. Finally, the lesson looks at how plastics affect turtles, and whether we have enough information to take drastic action on plastics, or whether we need to wait for more research to be conducted.

Lesson steps	Learning outcomes
1. The best thing about plastic (10 mins) The lesson starts with students considering what makes plastic such a great material by looking at common plastic items.	• Consider how the properties of plastic make it so popular
2. What happens to litter in the ocean? (15 mins) Students plot the time it takes for different types of marine litter to biodegrade and discuss how this should influence our choice of materials.	• Rank how different types of litter biodegrade in the ocean
3. Plastics and turtles (10 mins) Turtles are one of the species where there is a good body of evidence for the impact of plastics. Students create statements on the harm caused by plastics using sentence segments.	• Suggest how plastics can harm turtles
4. Do we know enough? (20 mins) Action on plastics is being implemented by many cities and countries. Students need to evaluate the current evidence and decide whether drastic action is now required.	• Evaluate whether there is enough scientific evidence to take drastic action on plastics
5. The worst thing about plastic (5 mins) As a plenary, return to the starter and decide what the worst thing about plastic is.	• Consider how the properties of plastic make it so harmful

TEACHER GUIDANCE 2 (page 1 of 3)
WHAT IS PLASTIC AND WHY IS IT A PROBLEM IN THE OCEAN?

Step	Guidance	Resources
1 10 mins	This lesson develops students' knowledge of marine plastic pollution and the harm it causes. · Share the learning objectives for the lesson. · Show students a small display of everyday plastic objects and ask students to answer the question 'What is the best thing about plastic?' · Students can note their thoughts on Student Sheet 2a or in their books. · Conduct a whole class discussion to review the activity and use the material properties on slide 4 as support. If you have not had time to bring in plastic items, you can use the images on slide 3 instead. The starter activity for this lesson requires bringing in examples of plastics. These could include a plastic drinks bottle, item of synthetic clothing, food container, packet of crisps, sweets or chocolate wrapped in plastic, plastic bag, or plastic toy. Try to have a good selection of six to eight items. Ensure that all plastic waste is fully clean or unopened, and that any used packaging does not present sharp edges.	**Slideshow 2:** Slides 1-4 **Student Sheet 2a:** Plastic starters
2 15 mins	One of the properties that students may have observed for plastics is durability. In Step 2, students develop insights into why the durability of plastic is creating environmental problems. · Introduce this lesson step by reviewing the scale of single-use plastic consumption with slides 5-7. · You may want to ensure that students understand what is meant by single-use. · Hand out copies of Student Sheet 2b for students to complete in pairs. · Slide 8 shows a copy of the infographic. Use this to model the first activity with your class. · Conduct a mini-plenary to review answers with your class, focusing again on the strangeness of using a highly durable material for single-use. There can be some confusion over whether plastic is biodegradable. Plastic can break down in the environment forming smaller and smaller pieces, but this is not through biological processes. In the ocean, floating plastic is exposed to UV light from the sun. This tends to make plastic bottles and other flexible plastics more brittle. Wave action then breaks up this brittle plastic into smaller particles.	**Slideshow 2:** Slides 5-8 **Student Sheet 2b:** What is plastic and why is it a problem in the ocean?

Step	Guidance	Resources
3 10 mins	Step 3 moves students onto considering the harm that plastics in the environment cause marine life. This starts with looking at turtles. · Slides 9-11 show the harm that plastic can cause to turtles. · Student Sheet 2c provides students with information about the potential impact of plastics on turtles in the form of sentence starters (the issue), sentence middles (the impact) and sentence ends (the harm). · Challenge your students to create as many sentences as possible that they think describe the harm caused by plastics to turtles using a starter, middle and end. Set a time limit of four minutes. · Review this activity using slides 12-14.	**Slideshow 2:** Slides 9-14 **Student Sheet 2c:** Plastics and turtles
	Depending on the age of your class, consider whether some of the photos are too graphic.	**Subject Update:** Learn more: Sources of marine plastic pollution
4 20 mins	Step 4 broadens out the study of the harm that plastics can cause in the ocean. There are some things that we do know, such as animals becoming entangled in plastic and larger items of plastic blocking and filling the stomachs of animals such as sharks, whales and turtles. However, there is still research to be done to confirm the impact of microplastics on smaller animals and also the chemical harm that plastics can cause marine life. This lesson step asks students to assess whether action should be taken to tackle marine plastic pollution given the current knowledge base. · The slideshow leads students through the current level of knowledge about the harm caused by plastics in the marine environment. Further information is available in the Subject Update. · Slides 17 and 18 describe the ubiquity of plastics in the environment. · Slide 19 describes how species can become entangled in plastic debris including fishing nets. This is well documented. · Slide 20 describes how large pieces of plastic can fill or block the stomachs or marine animals leading to reduced energy, starvation and death. · Slide 21 cautions against the fear that the seafood we eat could be a source of plastics, whereas it has been shown that we consume more plastic from our domestic environment. · Slide 22 introduces microplastics and the fact that they are small enough to be eaten by more species.	**Slideshow 2:** Slides 15-26 **Student Sheet 2d:** Plastic action vote **Subject Update:** Learn more: How does plastic harm the marine environment?

Step	Guidance	Resources
	· Slide 23 looks at smaller sea creatures, plankton. There are laboratory studies have shown harm to plankton in terms of reduced growth and reproduction, but this has been hard to observe in the natural environment. · Slide 24 introduces the idea of toxins as part of the plastic problem. Toxins in the ocean do adhere to plastic particles, but the jury is still out as to whether this transfers toxins to marine life more effectively. · Slide 25 looks at nanoplastics, which are particles small enough to cross the cell membrane. This is a worrying development, but particles are currently too small to detect in the open ocean, so this area remains an unknown. · Students will then work in groups to decide whether there is enough evidence to support drastic action, some action or whether we should wait until more information is available. · Ask a spokesperson from each group to present the group's choice, justifying their decision.	
	The work of the photographer Chris Jordan (http://www.chrisjordan.com/gallery/midway/) and the Blue Planet II clip of the dead pilot whale calf (https://www.bbc.co.uk/programmes/p05nslnh) are useful in providing a more emotive view of the impact of plastics.	
	This is a complex issue and an area of current study by the international science community. An assessment of the research on the harm that plastic causes marine life is presented in Learn more: How plastic harms the marine environment. Some NGOs have used misleading statements that exaggerate what we know about the harm that plastics cause. This is unhelpful in the long term as it can erode public trust in environmental reporting. However, the precautionary principle – assume the worst, until there is proof of no harm – steers us towards taking action on plastics, before a deeper understanding of the harm caused by plastics is reached.	**Subject Update:** Learn more: How plastic harms the marine environment
5 5 mins	End this lesson by revisiting the starter activity, and asking students 'What is the worst thing about plastic?'	**Slideshow 2:** Slide 27

STUDENT SHEET 2a

Plastic starters

Starter statement

The best thing about plastic is...

Plenary statement

The worst thing about plastic is...

STUDENT SHEET 2b

What is plastic and why is it a problem in the ocean?

200 years	6 weeks	2 months	10-20 years
ALUMINIUM CAN	NEWSPAPER	FRUIT CARDBOARD	PLASTIC BAG
3 months	**600 years**	**1-5 years**	**2-5 months**
COTTON T SHIRT	FISHING LINE	WOOLLEN SOCK	WAXED CARTON
450 years	**2-4 weeks**	**50 years**	**1-3 years**
NAPPY / DIAPER PLASTIC BOTTLE	PAPER TOWEL	TIN CAN FOAM CUP	PLYWOOD

Timeline showing .....

0 | 100 years | 200 years | 300 years | 400 years | 500 years

STUDENT SHEET 2b

1. Work in pairs. Complete the timeline showing how long these everyday items take to break down.

Newspaper	Cotton clothing	Plastic bags	Disposable nappies
Plastic bottle	Woollen socks	Styrofoam cups	Fruit cores / skins
Plastic cups / holders		Nylon fishing line / nets	

2. Circle or highlight the items composed of plastic on your timeline

3. Which tends to break down first, items composed of plastic or those made of natural materials?

.....

4. Why could that be a problem if plastic waste keeps being added to the sea?

.....

.....

5. Which item takes a longer time to break down than some plastic items?

.....

A yoghurt pot, bought for 11p in the 1970s, was discovered in a beach clean-up in Teignmouth, Devon, well over 40 years after it had been bought.

6. 'The best thing about plastic is its durability. The worst thing about plastic is its durability' Explain why this statement describes our use of plastic and its disposal well.

.....

.....

.....

Plastics and turtles

Recent research has estimated that more than half of all sea turtles have eaten plastic. Turtles eating just one piece of plastic have a 20% chance of dying, eating 14 pieces raises this to a 50% chance. Young turtles are at a greater risk, confusing plastic for food. Turtles can confuse plastic bags floating in the ocean for jellyfish, which are their natural prey.

Challenge

Cut out the cards below and make as many complete sentences as you can by choosing...

one problem card & one effect card & one harm card

Problem card...	**...effect card...**	**...harm card.**

You have 4 minutes to investigate the different ways that plastic can harm turtles.

Wilcox et al. A quantitative analysis linking sea turtle mortality and plastic debris ingestion. Scientific Reports volume 8, Article number: 12536 (2018)

STUDENT SHEET 2c

Turtles eating plastic can cause...	Turtles getting entangled in plastic can cause...	Plastic on the beach can cause...
...cuts and other injuries, which can lead to...	...problems swimming, which can lead to...	...blockage of the intestines which can lead to...
...internal injury, which can lead to...	...malnutrition, which can lead to...	...increased buoyancy, which can lead to...
...turtle nests to become warmer, which can lead to...	...reduced growth.	...more turtle hatchlings being female.
...poor health.	...death.	...difficulty in escaping predators.
...drowning.	...starvation.	...difficulty in finding food.

Plastics action vote

There are a lot of things that scientists know about plastics in the ocean and the harm it can cause and there are a number of issues that still need to be researched in more depth.

Your job is to decide whether action should be taken based on the amount of information we have available or whether we should wait until we know more.

What we do and do not know.

Plastic has been found in every part of the ocean where scientists have sampled for it.	Scientists have not been able to find nanoplastics in the ocean and don't know how they behave.
Large pieces of plastics can block the intestines of marine animals.	Humans eat more plastic from their home environment than from seafood.
Scientists are not sure what harm microplastics cause plankton in the open ocean.	There is some evidence that microfibres can cause cuts in marine worm guts in laboratory settings.
Plastic can entangle and lacerate large marine species such as turtles and whales.	As plastic breaks into smaller pieces (microplastics), it can be eaten by more species.
Nanoplastics are very small particles that can travel through the gut into the tissue.	Chemical toxins stick to plastic particles in the ocean.
Plastic has been found in the intestines of about 700 marine species.	Scientists do not know whether toxins absorbed by plastics cause more harm.

Your choices...

take drastic action	**take some action**	**wait until we know more**

Lesson 3:
Plastic case study - tourism in Kenya

Students visit Lamu in Kenya to discover the economic and social impacts of marine plastic pollution through a tourism case study.

Resources in this book:


Lesson Overview 3


Teacher Guidance 3


Student Sheet 3a: Lamu tourism brochure

Student Sheet 3b: Holiday heaven or paradise lost to plastic?

Student Sheet 3c: Lamu mapping

Student Sheet 3d: The Flipiflopi project

Resources available online:


Slideshow 3: Plastic case study - tourism in Kenya


External Link: Yes We Can! Shela to Kipungani Beach Cleanup

External Link: DePollutionizing Shela Beach

All resources can be downloaded from:
encounteredu.com/teachers/units/ocean-plastics-geography-ages-11-14

Plastic case study - tourism in Kenya

Age 11-14

60 minutes

Curriculum links

- Analyse why plastic pollution can have economic and social impacts
- Use mapping skills to assess sources of plastic pollution

Resources

Slideshow 3:
Plastic case study – tourism in Kenya

Student Sheet 3a:
Lamu tourism brochure

Student Sheet 3b:
Holiday heaven or paradise lost to plastic?

Student Sheet 3c:
Lamu mapping

Student Sheet 3d:
Flipflopi case study

External Link:
Yes We Can! Shela to Kipungani Beach Cleanup

External Link:
DePollutionizing Shela Beach

Extension or home learning

Students create a report or presentation on the Flipiflopi project.

Lesson overview

Plastic does not just have an environmental and health impact, it can also affect economies and communities. For tourism locations, a pristine beach will attract more visitors than one covered in plastic waste. In this lesson, students will look at a tourism case study on Lamu Island off the coast of Kenya.

Lesson steps	Learning outcomes
1. What makes Lamu popular? (15 mins) Students view a range of information about Lamu and assess what they think makes Lamu a popular tourist destination.	• Assess what makes Lamu a popular tourist destination
2. Where might plastic be coming from? (15 mins) Lamu's beaches are being affected by marine plastic pollution. This could have a knock-on impact on the local tourist industry. Students use their prior knowledge and a mapping activity to develop an understanding of potential sources of plastic.	• Apply mapping skills to describe processes • Evaluate the threat caused to Kenya's economy by plastic waste
3. What action is being taken? (15 mins) Students watch a video about the Lamu beach clean-up, and actions of volunteers and residents' groups to tackle the plastic build up.	• Describe how actions at a range of scales are addressing plastic pollution
4. How is Kenya changing? (10 mins) The build-up of plastic waste could stymie Kenya's strategy to grow its tourism sector. Students review development data about Kenya to reflect on the potential impact of plastic waste on the Kenyan economy.	• Evaluate the threat caused to Kenya's economy by plastic waste
5. How can the Kenyan government help? (5 mins) As a plenary, students suggest additional actions that the Kenyan government could take.	• Describe how actions at a range of scales are addressing plastic pollution

TEACHER GUIDANCE 3 (page 1 of 3)
PLASTIC CASE STUDY - TOURISM IN KENYA

Step	Guidance	Resources
1 15 mins	Having looked at the environmental impact in the previous lesson, students now examine the potential social and economic impact of plastic waste. · Share the learning objectives with class. · Locate Lamu on a map either using an atlas, globe or a digital map such as Google Earth (https://earth.google.com). · Hand out Student Sheets 3a and 3b. Student Sheet 3a contains a range of information about going on holiday to Lamu and is in the form of a tourist brochure. · Introduce the information and questions 1-3 on Student Sheet 3b, using slides 4-8. · Working in groups, students should then complete the questions. · Debrief as a whole class mini-review.	**Slideshow 3:** Slides 1-8 **Student Sheet 3a:** Lamu tourism brochure **Student Sheet 3b:** Holiday heaven or paradise lost to plastic?

Lamu county in Kenya covers both islands and coastal areas. The mainland area is subject to massive government development to create an international hub super-port, oil exploration and pipeline, with huge environmental destruction and disputes with the local fishing and small farmer community.

Lamu island, itself, is a small part of the overall Lamu county with a population of 13,243 (2009). In contrast, it is a small idyllic tourist centre, a UNESCO World Heritage Site on the coast of North East Kenya and is the focus of this lesson.

The population is historically mixed of Arab and African origin, as well as many Europeans who have returned to start businesses or buy houses after holidays spent on the island. It has attracted stars and politicians (Barack Obama) as holiday makers and, like the rest of Kenya's tourist industry has largely recovered from the post 2011 dip following a series of terrorist and kidnapping incidents which affected the Island directly. Parts of the island are struggling with the rise in tourist numbers, particularly Lamu Town which has heritage status, and is probably the oldest town in Kenya. Refuse collection and donkey droppings (6,000 donkeys) are an explicit and obvious problem and many tourists prefer to stay in Shela, the focus of the study, instead of Lamu because it is cleaner, and where cars are banned but tractors are allowed.

However, here plastic pollution is a problem which is growing to a very noticeable extent and has the potential, to derail the development of tourism by damaging the environment and habitats essential for a tourist based economy.

Step	Guidance	Resources
	Residents have reacted against plastic in two discrete but interlinked ways. Beach clean-ups took place over several months in 2017 and coincided with the Kenyan Government's introduction of the world's most draconian ban on plastic bags. However, in the year since the clean-up, it is estimated 10 tonnes of plastic has been deposited and collected from the beaches. Alongside this, an advocacy and awareness programme has seen a dhow made from plastic waste, the Flipflopi, which visits coastal communities to raise awareness and action. This is the focus of the home learning activity.	
2 15 mins	Having considered what makes Lamu an attractive tourism destination, students consider what the impact of plastic might be. · Students review three quotes from locals that describe the increasing plastic waste problem. These show that the plastic problem represents a change in the human / physical landscape interaction over a relatively short time period. · For effective actions to be taken, it is important to know where the plastic waste that is littering the beach comes from. · Relying on students' prior knowledge about urban populations consuming more convenience items such as those using plastic packaging, students may also consider how likely populations in LICs and MICs may reuse and recycle more than in HICs. · Students annotate the two maps on Student Sheet 3c with details of potential sources of plastic pollution. These might include: plastic escaping from the Indian Ocean gyre, fed by countries in Africa and Asia; local visiting tourists; Kenya itself, particularly coming from the capital Nairobi, and carried by rivers to the sea and carried north by the Somali Current.	**Slideshow 3:** Slides 9-12 **Student Sheet 3c:** Lamu mapping
3 15 mins	By this point in the lesson, students will have learned that Lamu's environment is being affected by plastic pollution and that this has potential knock-on impacts on the tourist industry. This lesson step looks at the appropriate actions that can be taken to address this. · Students watch either of the two listed videos. A longer, 9 minute video gives more information and a shorter 1 ½ minute version if you are stuck for time. · Students should answer questions 4-7 on Student Sheet 3b individually or as a whole class discussion.	**Slideshow 3:** Slides 13-15 **Student Sheet 3b:** Holiday heaven or paradise lost to plastic? **Video** Yes We Can! Shela to Kipungani Beach Cleanup **Video** DePollutionizing Shela Beach

TEACHER GUIDANCE 3 (page 3 of 3)
PLASTIC CASE STUDY - TOURISM IN KENYA

Step	Guidance	Resources
	Delete the slide for the video that you will not be using. These videos are hosted on YouTube and you may need to unblock this service, liaising with your IT department. The links for the videos are: Yes We Can! Shela to Kipungani Beach Cleanup (9 mins) https://youtu.be/MnNUnAjP4Ck DePollutionizing Shela Beach (1 ½ mins) https://youtu.be/zCu_V9wMb9k	
4 10 mins	Step 4 broadens out students' thinking about the economic and social impact of plastic waste to include development and economic data on Kenya. · Review the information on slides 16-19. · Complete questions 8-10 on Student Sheet 3b.	**Slideshow 3:** Slides 16-19 **Student Sheet 3b:** Holiday heaven or paradise lost to plastic?
5 5 mins	End the lesson, by asking students what additional actions the Kenyan government could be taking to address the issue of marine plastic pollution and its knock-on impacts on the economy and community of Lamu island. · Slide 20 shows a postcard template addressed to the Minister of the Environment. · As a whole class discussion, students consider what Lamu residents might suggest.	**Slideshow 3:** Slide 20
+	Students create a report or presentation on the Flipflopi project individually or in groups.	**Student Sheet 3d:** The Flipiflopi Project

Lamu tourism brochure

Welcome to Lamu - Kenya's Indian Ocean holiday retreat

Oldest town in Kenya
Unique cultural heritage
Amazing cuisine
Romantic restaurants
Historic architecture
Fascinating museums

Dhow trips
Nearby crystal clear seas
Coral reefs
Majestic mangrove swamps
Marine safaris
Turtle breeding grounds

Glorious golden beaches
Soft, soft sand
White rolling dunes
Car-free island
Donkey transport
Resort for many stars

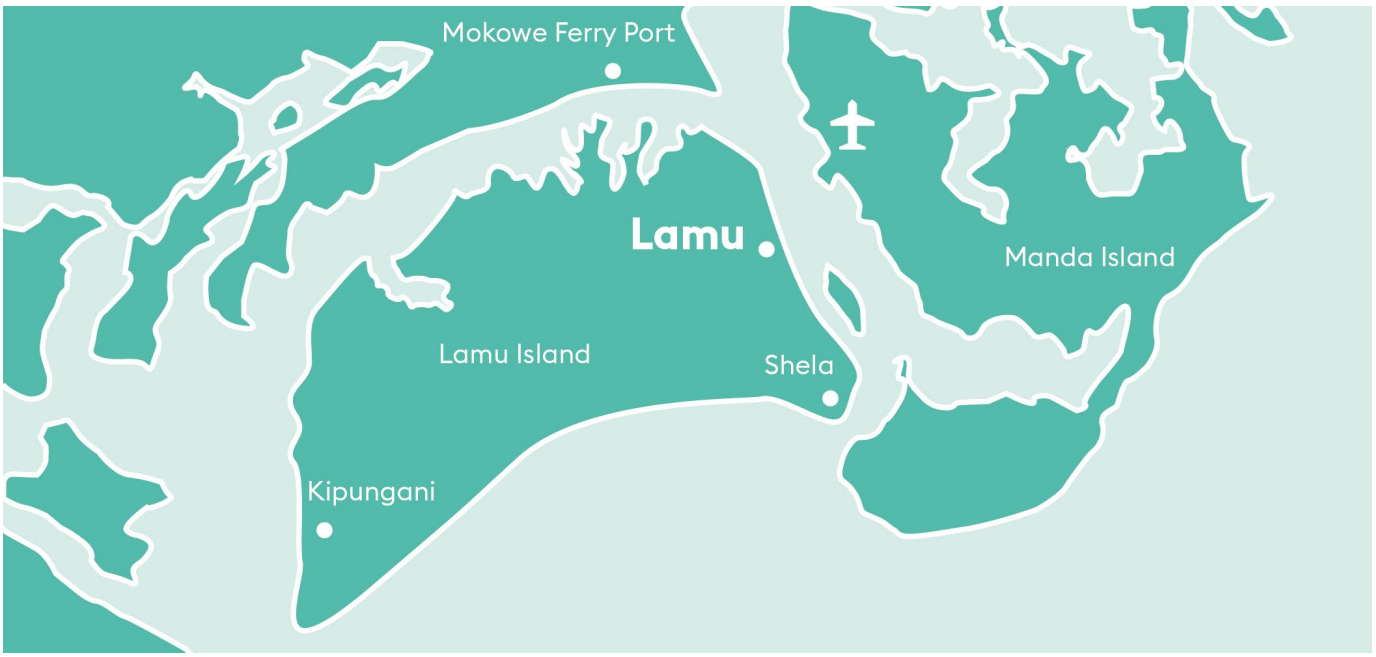
Lamu, oldest Swahili settlement in Kenya, rich in history and culture, blessed with exquisite natural beauty, a magical place of pure white sandy beaches, pristine rolling dunes, crystal turquoise seas, bounteous marine life, tranquil back waters and lush mangrove forests awaits. Its grassy plains hold some of Africa's last truly wild game and birds.

The early inhabitants were merchants, fishermen, dhow builders and sailors, many still follow these age-old trades. A painstakingly preserved UNESCO World Heritage Site, trusty donkeys remain the main mode of transport, dhows land fresh fish daily.

Lamu is becoming known not only as a wellness destination but also a conservation wildlife destination, offering a wealth of unmatchable experiences for holiday makers. Windmills and solar panels provide clean electricity.

The Lamu Tourism Association has over 120 members including hotels, guesthouses, lodges, private villas; restaurants, shops and galleries; yoga and wellbeing centres; water sports companies; fishing and dhow charters; airline and bus companies; local businesses; tour guiding and conservation associations; banks and Government bodies. All can help you to discover Lamu.

STUDENT SHEET 3a

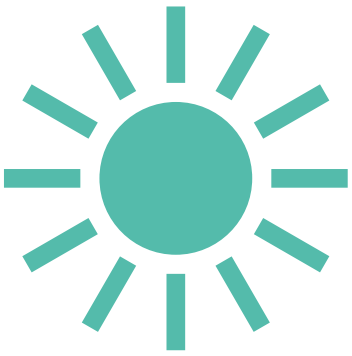


Act Now!

Places are limited.

3 day breaks to lovely Lamu Island.

From £220 - accommodation, meals, transfers and return flights to Nairobi included



J	F	M	A	M	J	J	A	S	O	N	D	
28	28	29	28.5	27	26	25	25.5	26	27	28	27	avg. Monthly Temperatures (°C)
6	4	25	130	329	164	75	40	39	40	39	28	avg. Monthly Rainfall (mm)

STUDENT SHEET 3b

Holiday heaven or paradise lost to plastic?

Questions based on Student Sheet 3a Lamu tourism brochure

1. Briefly describe the location of Lamu Island.

2. Study the sources provided and using at least one piece of evidence from each source, suggest six reasons why you might want to visit Lamu for a holiday.

3. With a partner, read the passage on the first page of the tourist brochure. Discuss and highlight all the words that suggest that the Lamu Tourist Association wants to present itself as a pure, unspoiled holiday destination. Summarise how important you think this is to Lamu's tourism in one sentence.

Questions based on the video

4. List four plastic items recovered from the beach.

5. Giving reasons, suggest one type of rubbish you think may have originated locally.

6. Suggest one way that Lamu's visitors could help reduce this source of plastic from reaching the beach.

7. Consider the proportion of flip flops compared to the total amount of rubbish recovered from the beach. Say whether you think most of the flip flops are from local sources or they have originated further away.

In 2017 Kenya introduced a total ban on plastic bags, with the most severe penalty in the world - $40,000 (£31,000) or up to 4 years in jail for manufacturing, selling or using them.

Kenya has a Human Development Index of 0.59, ranking 142nd in the world, and has a per capita income of $2900 and a life expectancy of 67. Nearly one million Kenyans fall below the poverty line each year because of healthcare related expenses. Tourism is Kenya's leading foreign income earner in most years. The Kenyan government is seeking to double the country's income from tourism in the next few years.

Questions based on Kenya's development and legislation.

8. How might the plastic bag ban affect:
   a) the visual appearance of Shela beach?
   b) the health of marine life around Lamu?

9. If plastic continues to increase how might it affect the tourist industry in Lamu?

10. In one word, how important is tourism to development in Kenya and Lamu?

Lamu mapping

1. Using an atlas, complete and annotate the maps of Kenya and the Indian Ocean on the following page with the following information. Choose carefully which information needs to go on each map and ensure that the Somali current is marked on both maps.

MOMBASA	NAIROBI	LAMU ISLAND	EQUATOR
NAIROBI ATHI RIVER	INDIAN OCEAN	SOMALI CURRENT	N. EQUATORIAL CURRENT
S. EQUATORIAL CURRENT	W. AUSTRALIAN CURRENT	AGULHAS CURRENT	INDIAN OCEAN GYRE
SOMALIA	UGANDA	ETHIOPIA	TANZANIA

2. Using the information these maps now provide, name three possible sources of the plastic pollution and in each case describe how it could have travelled to reach Lamu's Shela - Kipungani beach

1 .....

.....

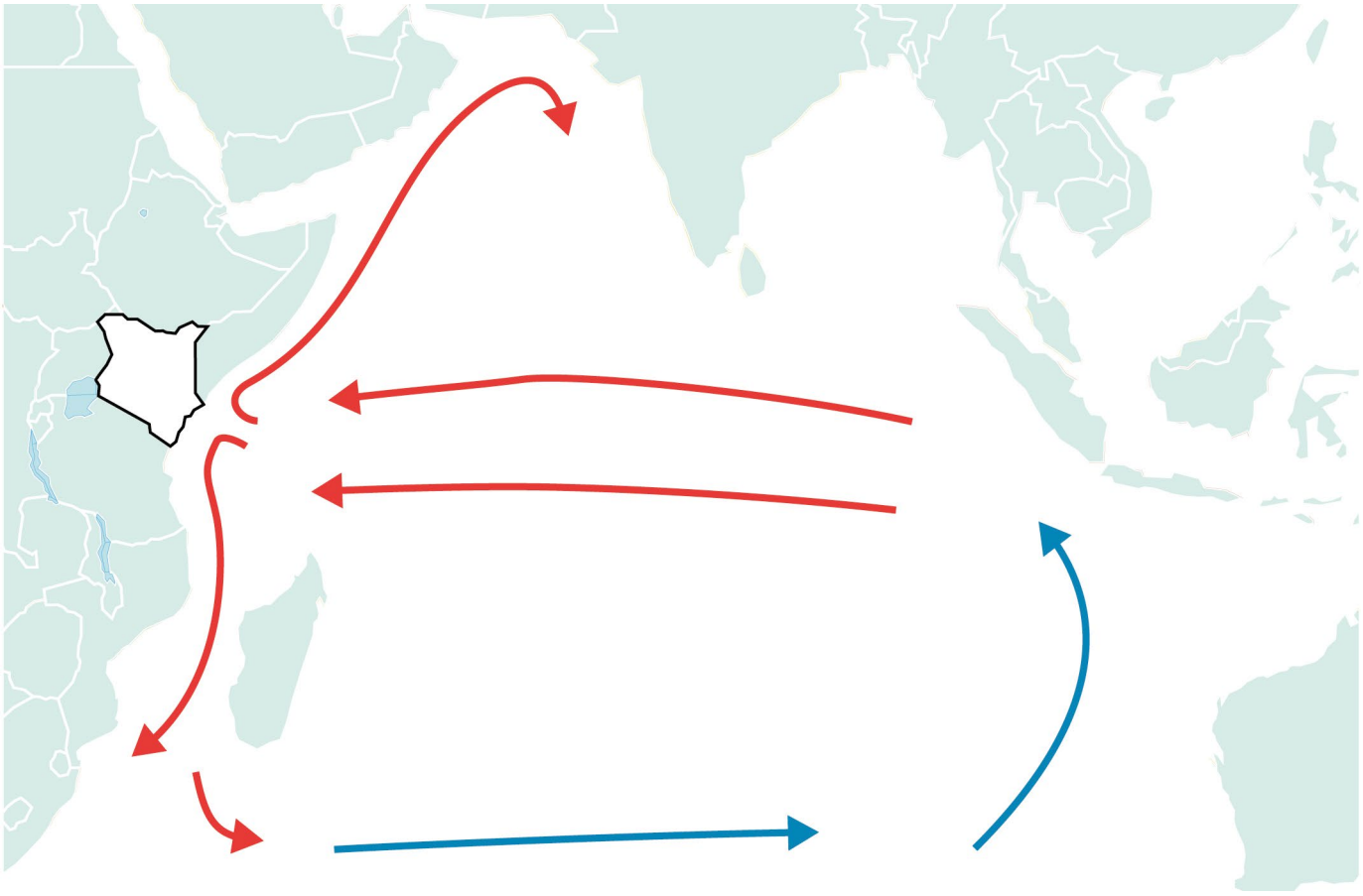
2 .....

.....

3 .....

.....

STUDENT SHEET 3c



The Flipflopi Project

Another major action taken against plastic pollution has been the Lamu Flipflopi project. A dhow, a type of traditional fishing boat, can take up to 50 trees to build. So, instead, a master boat builder has built a dhow completely of recycled and repurposed plastic, with the exception of the wooden mast.

Using the internet to research, create an A3 educational poster or multimedia presentation about the Flipflopi project.

Perhaps start with...

An introductory film about the Flipflopi project: https://vimeo.com/322596933

Visit the Flipflopi project website: http://www.theflipflopi.com

Success criterea

Your report **must**

- **Describe** the materials and quantities used
- **Give** the dimensions of the boat
- **Include** an annotated drawing or picture of the boat
- **Use and explain** the terms **reduce, reuse, recycle, repurpose** and **already used plastic** in the context of the Flipflopi boat building project
- **Explain** at least two reasons for starting the project
- **Emphasize** why it is so important to Lamu's and Kenya's tourist industry to combat plastic pollution
- **Assess** the success of the project against its stated purposes

Lesson 4:
How can we deal with all the plastic waste?

Students understand the enormity of the amount of plastic being manufactured and investigate solutions such as recycling and new economic models may help.

Resources in this book:


Lesson Overview 4


Teacher Guidance 4


Student Sheet 4a: Recycling cards

Student Sheet 4b: A new economy

Student Sheet 4c: What happens to plastic waste in Asia and Africa?

Resources available online:


Slideshow 4: How can we deal with all the plastic waste?


Thinglink: Global plastics production

Thinglink: Life cycle of a plastic bottle

All resources can be downloaded from:
encounteredu.com/teachers/units/ocean-plastics-geography-ages-11-14

How can we deal with all the plastic waste?

Age 11-14

60 minutes

Curriculum links

- Understand key processes in human geography: use of natural resources and economic development
- Understand how human processes change landscapes and environments

Resources

Slideshow 4:
How can we deal with all the plastic waste?

Student Sheet 4a:
Recycling cards

Student Sheet 4b:
A new economy

Student Sheet 4c:
What happens to plastic waste in Asia and Africa?

Diagram:
Global plastic production interactive

Diagram:
Life cycle of a plastic bottle

Extension or home learning

A home learning exercise can be set for students to investigate the global context of recycling.

Lesson overview

With plastic production already exceeding 300 million tonnes per year, the mountain of waste has the potential to grow and grow. This lesson looks at whether recycling can be a solution, before examining three different economic models to see if we need to change the way we look at plastic and plastic products. The lesson asks students to consider the impact of managed, unmanaged and mismanaged waste.

Lesson steps	Learning outcomes
1. How much plastic? (10 mins) Students analyse a graph of the increase in plastic production and decide how best to communicate these figures.	• Analyse the rapid growth in global plastic production
2. Where does the plastic go? (10 mins) Students study a graphic of the life cycle of a plastic bottle with special reference to disposal. They are asked to describe and then rank the different paths that plastic can take after it has been thrown away.	• Describe the different paths that plastic can take after disposal
3. How good are we at recycling? (15 mins) Students play a short game to see if they know what common items can be recycled. They are then given a variety of facts to discuss and then decide how effective the UK is at recycling.	• Consider how effective the UK is at recycling
4. Is recycling enough? (15 mins) Students will reflect on the fact that recycling may not be enough to tackle the plastic issue and that new ways of thinking may be needed as well.	• Decide whether a linear economy is fit for purpose in the 21st century
5. How can art help? (10 mins) As a plenary, students study the work of photographer Karl Taylor, and reflect on what art can bring to the understanding of an issue, that statistics and facts may not.	• Reflect on artistic works showing the plastic problem

TEACHER GUIDANCE 4 (page 1 of 4)
HOW CAN WE DEAL WITH ALL THE PLASTIC WASTE?

Step	Guidance	Resources
1 10 mins	The first three lessons examined the nature and impact of plastic pollution, this lesson starts the process of looking at waste management and potential solutions. The first lesson step looks at the scale of global plastic production. · Share the learning objectives for the lesson and connect to previous learning. · Give students two minutes to come up with a list of every single item of plastic they have touched so far today. · Compare lists as a whole class discussion, emphasising how plastic is a huge part of our everyday lives. · Use slides 4-6 to remind students that they may have come into contact with plastic without realising. · Use slide 7 to focus students on the amount of plastics produced each year since the 1950s. · Either writing in books or as a whole class discussion ask students to answer the question related to the graph on slide 7	**Slideshow 4:** Slides 1-7
	The graph on slide 7 is also available online as an interactive graphic at https://encounteredu.com/discover/images/global-plastic-production-interactive.	**Thinglink:** Global plastic production interactive
2 10 mins	One of the concepts to reinforce for students is to consider 'where is away?' when they throw something away. · Frame this section of the lesson using slide 8. · Review the pie chart on slide 9 to show how little plastic has been recycled historically and how much is potentially ending up in the environment. · Ask students to view the image on their devices individually or in small groups. · Showing slide 11, have students answer the two questions about what happens to a plastic bottle at and after disposal.	**Slideshow 4:** Slides 8-11 **Thinglink:** Life cycle of a plastic bottle
	The interactive image is viewable on all devices at https://encounteredu.com/discover/images/life-cycle-of-a-plastic-bottle. If individual or group devices are not available, review the interactive image on the board before answering the questions on slide 11.	

TEACHER GUIDANCE 4 (page 2 of 4)
HOW CAN WE DEAL WITH ALL THE PLASTIC WASTE?

Step	Guidance	Resources
3 15 mins	At this stage in the lesson, students should be realising that either more plastic needs to be recycled or less plastic needs to be used or both. Step 3 in the lesson looks at some of the issues involved in recycling. Recycling and its global context are explored more in the next lesson. · Frame this lesson step using slide 12 and hand out copies of Student Sheet 4a to groups. · Ask students to cut out the items to be recycled and as this is happening, review each of them in turn in case of any misunderstandings. · Showing slide 13, give student groups 2 minutes to short the cards into two piles, one for items that can be recycled and one for items that cannot. · Review student choices and use the recycling information below to help in this process. · Using slide 14 ask students if they would like to move any of their cards for East Riding of Yorkshire, the Local Authority with the highest recycling rates in the UK. See the info box below for the correct answers. · Using slide 15, ask students if they would like to move any of their cards again for Tonbridge in Kent. The short answer is that if you live in Tonbridge, the Local Authority does not offer any domestic recycling for plastic. · Now that students have a better sense of what can and cannot be recycled in the UK, start a quick recycling quiz. There are 10 questions and students can answer in groups. Additional information is in the third info box below. · Students will be able to debate and discuss some potential changes to how waste is managed in the UK in the next lesson.	**Slideshow 4:** Slides 13-35 **Student Sheet 4a:** Recycling cards

An analysis of doorstep plastic recycling by the BBC based on WRAP data (https://www.bbc.co.uk/news/science-environment-45496884) reveals the following percentage of households in the UK where plastic packaging is collected for recycling:

- Plastic film from fruit box – 11% (unlikely as these can jam machines and are often contaminated with food waste)
- Crisp packet – not recyclable
- Plastic takeaway container – 73%
- Coffee cup – almost never as these are made with several different materials laminated together
- Toothpaste tube – almost never because of the different plastics used
- Polystyrene packing – only 1% as expanded polystyrene crumbles into tiny pieces
- Plastic bottle – 99% of households can recycle these

Step	Guidance	Resources

- Plastic bag – only 18% of households can recycle plastic bags
- Bubble wrap – not recycled
- Plastic fruit box – 73% of households can recycle these
- Yoghurt pot – 74% of households can recycle these
- Plastic toys – not recycled because they are made of hard plastic

For East Riding of Yorkshire, the answers are:

Yes:	**No:**
Plastic takeaway container, Plastic bottle, Plastic bag, Plastic fruit box, Yoghurt pot.	Fruit box film, Crisp packet, Coffee cup, Toothpaste tube, Polystyrene packing, Bubble wrap, Plastic toys.

1. It has been estimated that nearly 5 billion plastic straws are thrown away in England each year – TRUE astonishingly.
2. 25% of Europe's plastics are used once and then thrown away – FALSE, the actual figure is 40%.
3. There are 39 different recycling schemes in the UK – TRUE and there are plans to rationalise this.
4. Over half of the councils in the UK recycle plastic bags – FALSE only 18% of households in the UK have access to recycling for carrier bags.
5. It is ok to make a mistake and put something wrong in the recycling bin – FALSE, contamination is one of the reasons why items become less econonomically effective
6. You have to wash or rinse all plastic items before you put them in the recycling – TRUE, this links to the contamination point above.
7. Black plastic cannot be recycled – FALSE, many areas won't recycle black plastic because it doesn't show up on conveyor belts. It is however recyclable but is worth less as cannot be made into other colours.
8. Symbols with the three arrows and a number mean that it is recyclable – FALSE, these numbers just refer to the chemical resin used to make the plastic. For more see https://encounteredu.com/discover/images/seven-types-of-plastic.
9. Approximately 13 billion plastic bottles are used each year in the UK – TRUE, that's nearly 200 per person.
10. Less than half of plastic bottles are recycled in the UK – FALSE, it's not that bad, but only just at 57%, which means that 15 million plastic bottles are still sent to landfill, incinerated or littered every day.

Consider changing the East Riding example for your Local Authority. Items that can be placed in domestic recycling can normally be found on council websites.

TEACHER GUIDANCE 4 (page 4 of 4)
HOW CAN WE DEAL WITH ALL THE PLASTIC WASTE?

Step	Guidance	Resources
4 15 mins	Step 4 broadens out students' thinking about whether tinkering with recycling rates is enough or whether a rethink of economic models is enough. · Hand out Student Sheet 4b to each student. The Student Sheet contains a diagram (shown on slide 37) and a cartoon (shown on slide 38). · Ask students to complete the questions. · Review the answers using the relevant slides. · Use slide 39 to prompt students to think about how small actions can help move towards an economy with less waste. Often the production of multi-use items, e.g. a cotton tote bag, has a much higher environmental impact than that of its plastic alternative. For instance, a cotton tote bag needs to be reused 130 times to have the same global warming impact as a plastic bag. The key here is reuse.	**Slideshow 4:** Slides 36-39 **Student Sheet 4b:** A new economy
5 10 mins	End the lesson, by moving from statistics and facts to an artistic response to the issue of plastics. · Introduce the work using the text on slides 40-42. · Show students the photos on slides 43 and 44, giving students time to reflect for at least a minute on each photo in silence. · Gather responses and ask how the photos have altered how they feel about plastic waste as opposed to the facts they have learnt earlier in the lesson.	**Slideshow 4:** Slides 40-44
+	Students study a wider context of waste management.	**Student Sheet 4c:** What happens to plastic waste in Asia and Africa?

Recycling cards

Plastic film from a fruit box	Crisp packet	Plastic takeaway container
Coffee cup	Toothpaste tube	Polystyrene packaging
Plastic bottle	Plastic bag	Bubble wrap
Plastic fruit box	Yoghurt pot	Plastic toys

A new economy

Sustainable economies

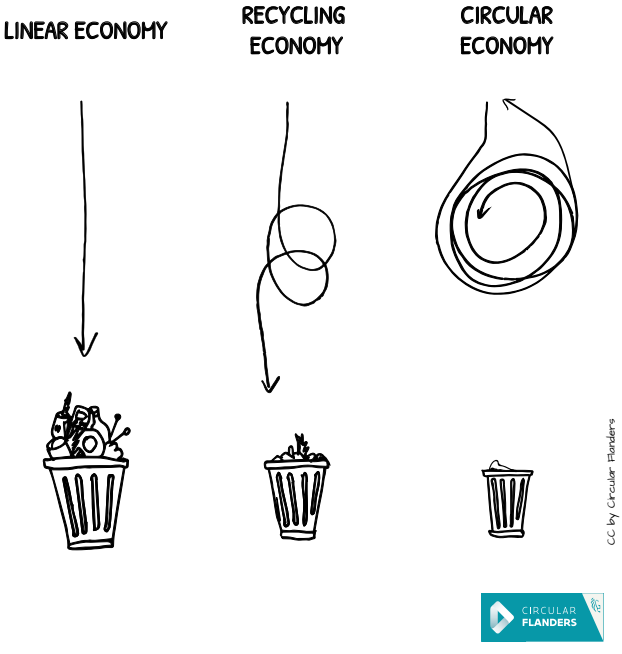
1. Explain the types of economies shown in the drawing on the left.

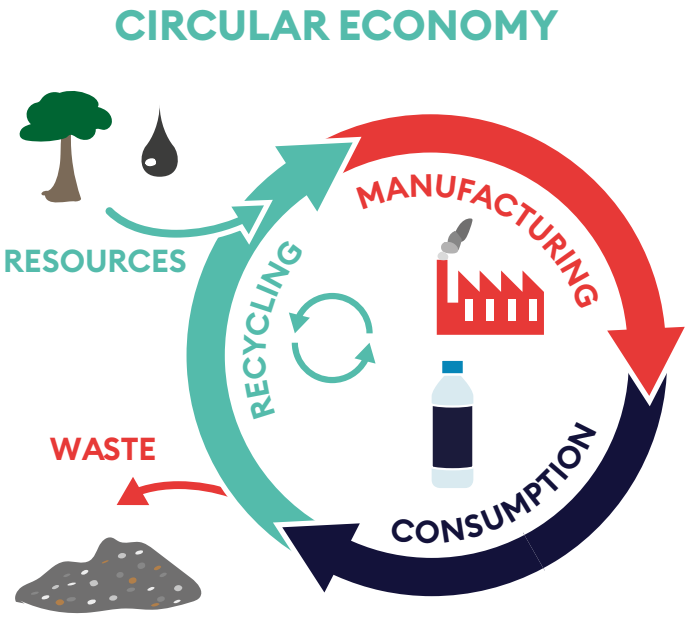
2. Using the information, describe:
   a) a linear economy.
   b) a recycling economy.

3. Describe a circular economy using the diagram on the right.

4. How does the plastic waste shown in the rubbish bins in the cartoon relate to the way that we manage waste?

5. Which of the three economies is the most sustainable and why?





What happens to plastic waste in Asia and Africa?

Countries with the most plastic marine debris

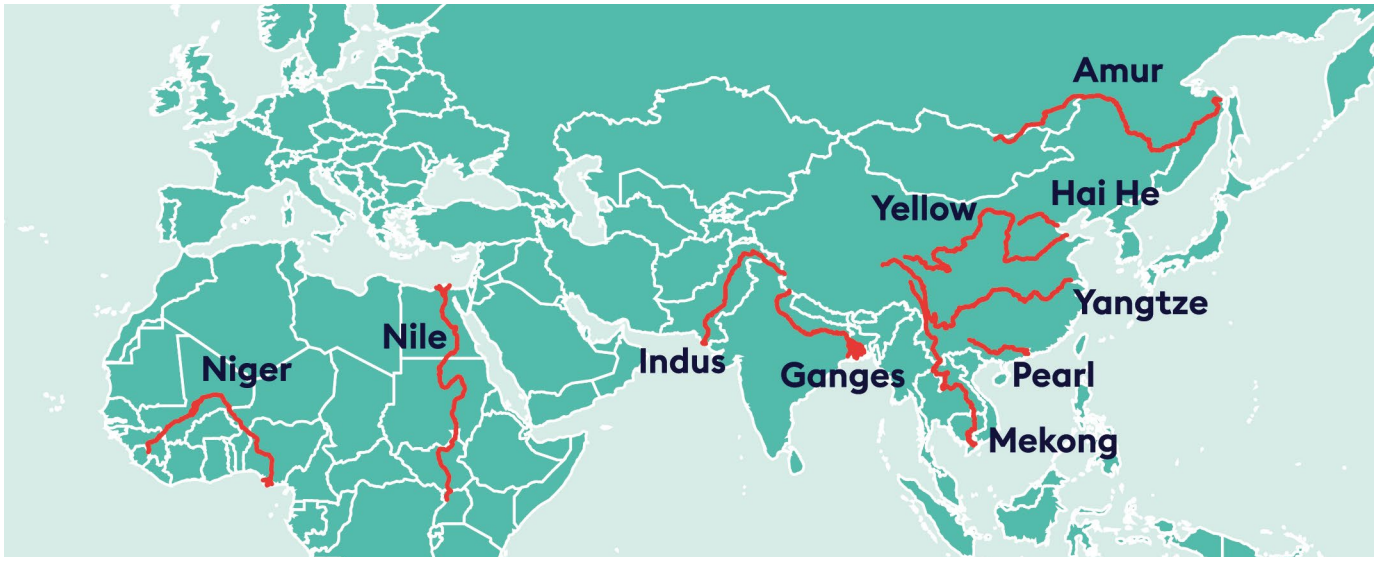
An estimated 8 million tonnes of plastic ends up in the oceans every year. 80% of this is from just 20 countries in the world. While China is a major polluter, contributing 2.4 million tonnes of plastic waste that wind up in the Earth's seas annually, it is certainly not alone. The contributions of other countries include:

Indonesia 0.81	The Philippines 0.47
Vietnam 0.45	Sri Lanka 0.40
Thailand 0.26	Egypt 0.24
Malaysia 0.23	Nigeria 0.21
Bangladesh 0.19	South Africa 0.16

1. Where are all these countries? Use an atlas to help you.

This map shows the top ten most plastic polluted rivers in the world.

Data: Schmidt et al. (2017)



2. Which single country is the location for five of these rivers?
3. Locate and name the countries through which these ten rivers flow.
4. Which rivers in the world outside Asia contribute large amounts of plastic to the oceans?

- When landfill falls short in accommodating all of our rubbish, societies have turned to the rivers. This results in rivers that are entirely covered with waste. When seen from above, these rivers look like a solid sludge of plastic waste. All these rivers flow into the ocean, bringing the trash with them.

- The top ten most polluted rivers in the world have one thing in common. They are located alongside large human populations with poor waste management systems. Together, they deliver almost all the plastics in the entirety of our oceans.

- Statistics show that throwaway junk in the form of plastic bags and bottles has risen by 620% since the year 1975.

Data: Jambeck et al. (2014)

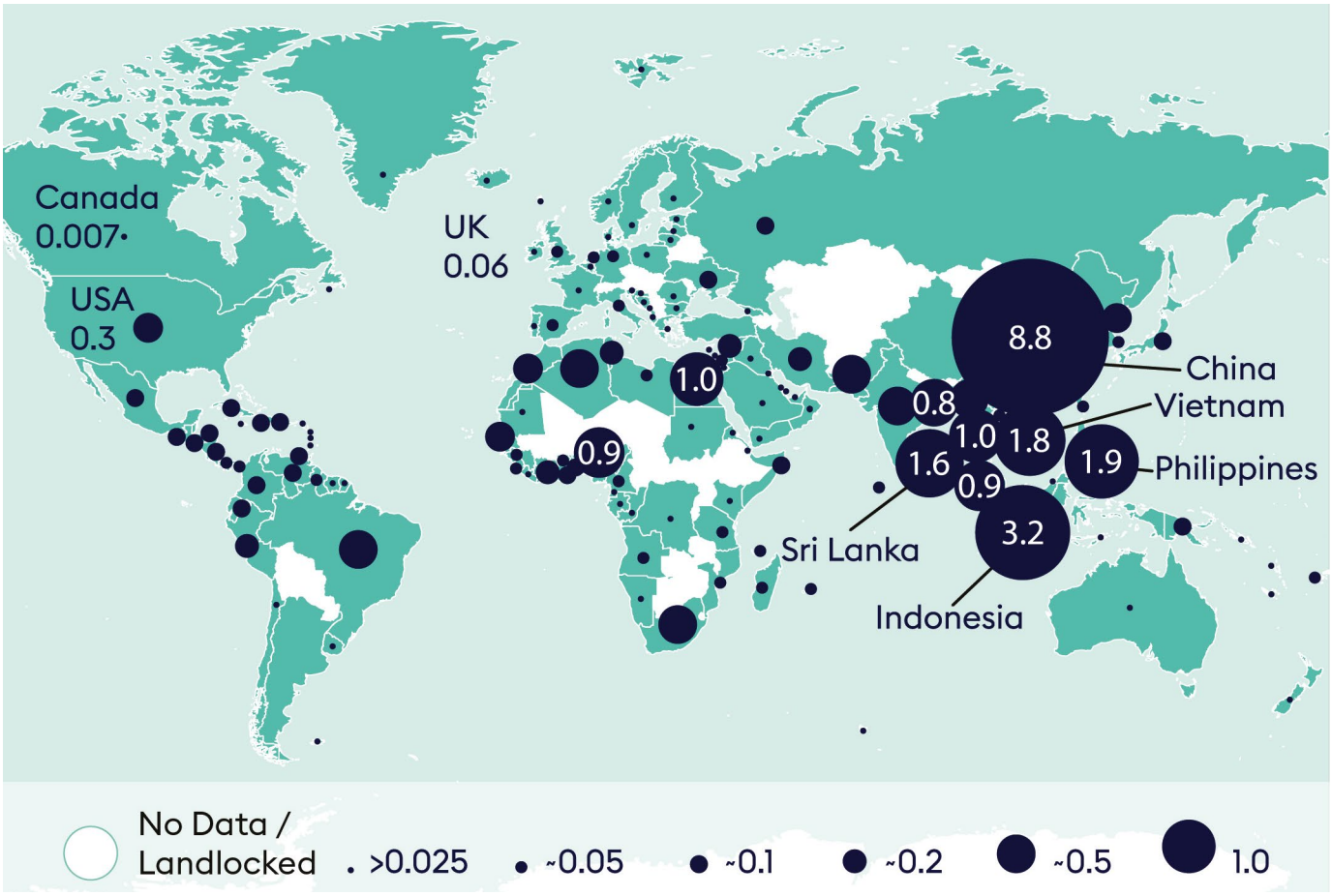


Chart showing plastic waste released by countries in 2010 in **million metric tonnes**

STUDENT SHEET 4c

China's Population		China's per capita disposable income	
1975	905,580,425	1978	343.40 Chinese Yuan (US Dollars: $49.70)
2015	1,376,048,943	2018	39251.00 Chinese Yuan (US Dollars: $5680.56)

Most countries in Asia and Africa have had a _____ population increase since the 1970s.

China's population has risen by _____. So, there are far more people using _____ .

Many people have moved from rural areas to _____ areas near major rivers and work in factories or services instead of growing their own food on _____ .

This means they have to buy food in shops and supermarkets and often carry it in cheap _____ .

Many people have more disposable income, e.g. China's disposable income has risen by _____ in the same period of time.

So people are able to buy consumer goods made of _____ and convenience foods wrapped in plastic increasing _____ further.

In many countries infrastructure like clean water supplies has not kept up in the cities so even people on _____ wages buy _____ water.

China alone used 73.8 billion plastic water bottles in 2016 and most were not _____ .

In countries like Nigeria waste collection and recycling is _____ .

In other countries non-regulated disposal companies dump waste _____ .

This means most will end up in the _____ and then be carried to the _____ .

5. Suggest two measures for countries to reduce their plastic contribution to the ocean.

Lesson 5:
The global journey of plastic waste

Recycling plastic is not just a domestic issue, but one of interconnected global trade and crime. In this lesson students explore how the UK exports its plastic waste.

Resources in this book:

Lesson Overview 5

Teacher Guidance 5

Student Sheet 5a: Plastic waste export maps

Student Sheet 5b: Waste management futures info

Student Sheet 5c: Waste management futures pyramid

Student Sheet 5d: Whose waste is it anyway?

Resources available online:

Slideshow 5: The global journey of plastic waste

All resources can be downloaded from:
encounteredu.com/teachers/units/ocean-plastics-geography-ages-11-14

LESSON 5

The global journey of plastic waste

Age 11-14

60 minutes

Curriculum links

- Understand key processes in human geography: trade, use of natural resources and economic development
- Understand how human processes change landscapes and environments

Resources

Slideshow 5: The global journey of plastic waste

Student Sheet 5a: Plastic export maps

Student Sheet 5b: Waste management futures info

Student Sheet 5c: Waste management futures pyramid

Student Sheet 5d: Whose waste is it anyway?

Extension or home learning

Students study a newspaper article from Indonesia about the need for western countries to take more responsibility for the impact of imported plastic waste.

Lesson overview

The UK exports over half a million tonnes of recovered plastic packaging each year. Historically, much of this was to China, but with a ban on waste imports other solutions and destinations have been sought. Students start by mapping the destinations of plastic waste exports before and after China's ban. Then students consider the UK's options, before ranking these and creating a proposal for action.

Lesson steps	Learning outcomes
1. How much plastic? (15 mins) Bans on imports by different countries are affecting the destination of these exports. Students create two maps to show changes in recent years.	• Map the global destinations of UK recycling over time
2. How and why has this changed over time? (10 mins) Using the data and maps from the previous lesson step, students write a short paragraph to describe how the destinations for recovered plastic packaging exports has changed over time.	• Describe how these destinations have changed over time
3. What are the options for future waste management? (15 mins) Working in groups, students are presented with a range of information on possible solutions and problems in reducing plastic waste in the UK.	• Review information on the current state of UK plastic waste management
4. Ranking recycling (15 mins) Student groups will need to rank a selection of proposals being considered by government and by industry for how to reduce the amount of plastic waste.	• Evaluate options for the future of UK plastic waste management
5. What should government do? (5 mins) Students write a paragraph stating their preferred option and giving reasons. These can be sent to the relevant political representative.	• Evaluate options for the future of UK plastic waste management

TEACHER GUIDANCE 5 (page 1 of 3)
THE GLOBAL JOURNEY OF PLASTIC WASTE

Step	Guidance	Resources
1 15 mins	In this lesson, students will consider the global context of recycling. This first lesson step is a mapping exercise, looking at the top importers of the UK's recovered plastic packaging. · Share the learning objectives and connect the learning to the previous lesson on recycling. · Use slide 3 to share the enquiry question for this lesson step. · Hand out two copies of Student Sheet 5a and atlases to students. Explain the mapping activity. · Students will need to create two chloropleth maps showing the amount of recovered plastic packaging exported to different countries from the UK in 2016 and 2018. · Students will need to select a title and a colour scheme for each weight bracket. · Students will then use atlases to locate the countries listed in the tables and shade these according to their map colour key.	**Slideshow 5:** Slides 1-4 **Student Sheet 5a:** Plastic export maps
	If you feel that students will not be able to complete both maps in 15 minutes, assign students to work in pairs, with one student completing a chloropleth map for 2016 and the other for 2018. It may make comparison easier, were both students in a pair to use the same colour scheme	**Image:** Global plastic production interactive
2 10 mins	Having completed the mapping exercise, students to analyse the differences between 2016 and 2018. · Prompt students by asking for initial thoughts about the main similarities and differences. · Students then complete a short paragraph in their books. · As a challenge, students can attempt the second question. · Some students may sense that something drastic must have happened with China. · If there is time probe any half-formed answers and steer students towards the realisation that China banned the import of plastic waste at the end of 2017.	**Slideshow 5:** Slide 5

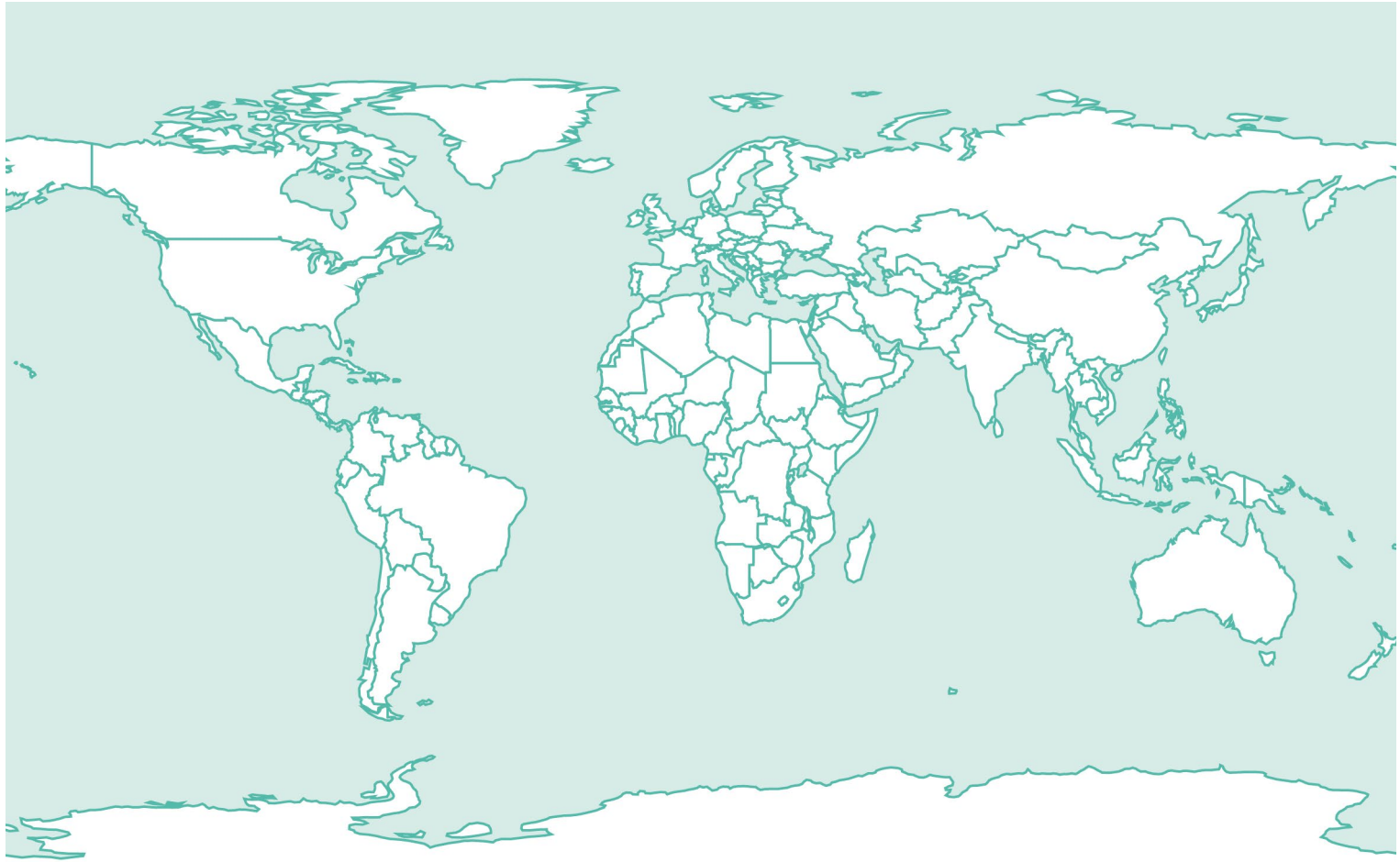
Step	Guidance	Resources
3 15 mins	With China banning the import of plastic, students are asked to consider what the alternatives might be for the UK. · Use slide 6 to frame this section of the lesson. Ask students whether they think that exporting waste to another country is the right thing to do anyway. · For this activity students can work in groups of 3-4. · Hand out copies of Student Sheet 5b which shows a range of information about recycling and waste management in the UK. · Students will need to have a good overview of the information before attempting the ranking exercise in Student Sheet 5c. · Students can cut out the info cards to make sharing easier. · Show slide 7 and ask students to scan the info cards and locate answers to the nine questions. · Review the answers as a whole class discussion to ensure that all students have a good grasp of the content of each card. The questions are in the order of the cards, and to increase the level of challenge, the order can be changed on slide 7.	**Slideshow 5:** Slides 6-7 **Student Sheet 5b:** Waste management futures info
4 15 mins	Step 4 asks students to apply the information on the info cards to a ranking exercise and put in order of preference the different options facing the UK government, especially in light of the plastic import ban by China and the increasing pushback by other countries in South East Asia. · Hand out Student Sheet 5c to each of the student groups. · Using slide 8 explain that there are several options on offer to government. For more challenge, tell students that they can come up with their own ideas based on their own knowledge and the info cards. · Slide 9 shows the pyramid that students need to select. · Debrief with a mini-plenary asking groups what they selected as their top option and why.	**Slideshow 5:** Slides 8-9 **Student Sheet 5c:** Waste management futures pyramid

TEACHER GUIDANCE 5 (page 3 of 3)
THE GLOBAL JOURNEY OF PLASTIC WASTE

Step	Guidance	Resources
5 5 mins	End the lesson, by asking student to write a short paragraph proposing a course of action to political representatives.	**Slideshow 5:** Slides 10
	The website WriteToThem (https://www.writetothem.com) lists the appropriate level of political representative by UK postcode. It lists contact details at all levels of political representation with guidance about the appropriate person to contact for different issues.	
+	Students study a newspaper article from Indonesia about the need for western countries to take more responsibility for the impact of imported plastic waste.	**Student Sheet 5d:** Whose waste is it anyway?

Plastic export maps

Map Title:



20,000-40,000	40,000-60,000	60,000-80,000	80,000-100,000	100,000-120,000	over 120,000

What happens to exported plastic?

Friends of the Earth conducted an investigation into what happened to exported plastic when it reached Indonesia.

The idea is that this plastic is processed into new plastic resin for new plastic products. However, evidence showed this plastic being picked and sorted by children, dumped in streets, washed into rivers, and being used for fuel in small factories, where the fumes can be harmful.

Interview with a Scientist

The consumer shouldn't be faced with this ethical challenge every time they go into the shop, of which type of packaging is better or worse than another.

"The products on the shelves in the supermarket, we as consumers ought to be able to rely on the packaging having the minimal environmental footprint necessary, and that that homework has been done for us, and that we are not faced with that challenge each time we go shopping as an individual."

Professor Richard Thompson, Director of the Marine Institute, University of Plymouth

Deposit return scheme

A recycling scheme in Norway recycles 97% of plastic bottles. It is known as a deposit return scheme. Every time you buy a drink in a plastic bottle, or an aluminium can, you pay a little extra (about 10p to 25p depending on the size of the bottle).

When you have finished your drink, you return the bottle to a reverse vending machine. You put the bottle in and it gives you a coupon repaying the deposit in return. If the bottle is not empty and clean, the machine will accept the bottle, but give the coupon to the shopkeeper who will need to clean the bottle for you.

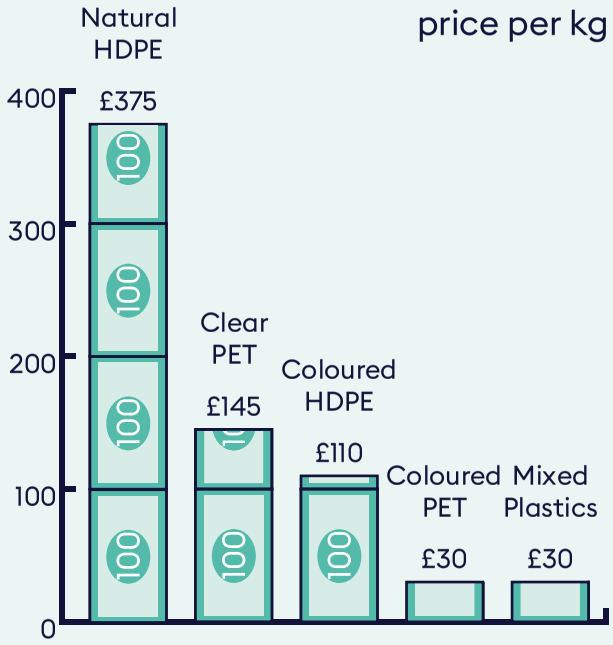
China bans plastic imports

Coming into effect on December 31, 2017, the import ban sought to crack down on plastics flooding into China, viewing it as a social and environmental hazard.

The report calculates that since 1992, China has imported 106 million tonnes of plastic waste, making up 45.1% of all imports worldwide, processing garbage from 43 countries on top of its own. China and Hong Kong have collectively taken in 72.4 % of all plastic waste.

Other countries in South East Asia carry out plastics recycling, but nowhere near the level of China. Recycling facilities in high-income regions such as Europe and North America are also thin on the ground.

Some plastics are worth more than others



HDPE is used to make milk bottles, and bottles for laundry detergent.

PET is used to make fizzy drinks and water bottles.

A green future: Our 25 year plan to improve the environment

In January 2018, the UK government set out a plan to reduce plastic waste. Measures included:

- Plastic bag charges of 5p to reduce the number of carrier bags in circulation
- Considering a deposit return scheme for drinks containers, including plastic bottles
- Intention to ban the sale of plastic straws, drink stirrers and plastic-stemmed cotton buds

The UK has already banned the use of plastic microbeads in cosmetics.

Plastic peppers

Media reports have shown that it is more expensive for consumers to buy certain fruit and vegetable items singly rather than in plastic packets.

For three major supermarkets in the UK, the price comparison for three peppers bought singly and three bought packaged together in plastic were:

Sainsbury's:
3 plastic peppers: £1.50
3 loose peppers: £1.10

Tesco:
3 plastic peppers: £1.65
3 loose peppers: £1.29

Asda:
3 plastic peppers: £1.65
3 loose peppers: £1.29

Figures derived from like for like peppers on offer on respective supermarket websites on 2 july 2019.

UK 'Plastic Pact'

On 26 April 2018, a number of UK supermarkets, food companies and plastics' industry members launched a new voluntary pledge, a 'plastic pact' to cut plastic packaging. It includes an aspiration that by 2025 all plastic packaging can be reused, recycled or composted.

There has been some criticism of the pact in the press as it is a voluntary measure, with no enforcement mechanisms.

UK headlines since Jan 2018 include:

- UK supermarkets launch voluntary pledge to cut plastic packaging
- Drinks bottles and can deposit return scheme proposed
- Coconut controversy as shoppers query use of plastic wrapping
- McDonald's aims for fully recycled packaging by 2025
- Coca-Cola pledges to recycle all packaging by 2030
- BBC to ban single-use plastics by 2020 after Blue Planet II

Does the China ban present an opportunity?

Simon Ellin, Chief executive of the UK Recycling Association warned that the ban could have severe consequences for council recycling in the UK, at least in the short term.

"If it no longer pays for our members to take this waste and sort it once it has been collected by councils then that might stop. That might mean that councils no longer collect recycling in the same way. It could be chaos."

Some experts believe that in the long term the decision by China could be an opportunity for the UK to develop its recycling infrastructure.
Ellin agreed that if there was the political will this could be an opportunity.

"We need to look at the entire system from producing less, to better, simpler design, to standardised recycling."

Waste management futures pyramid

Rank the potential solutions to waste management below using the pyramid, with the best option at the top and the worst at the bottom. You can write just the letters in the pyramid.

Use the information on the Waste management futures info cards and knowledge from previous lessons to complete the task.

A Charge 50p for every single use item, e.g. bags, straws and cups.	**B** Invest in UK recycling facilities to handle more recovered plastic and create green jobs.	**C** Locate new countries to export recovered plastic packaging to.
E Force all councils to use a national recycling scheme.	**F** Introduce reverse vending machines with all plastic bottles part of the scheme.	**G** Ban any plastic packaging that is not easily recycled.

Whose waste is it anyway?

Read the article 'Developed countries urged to pick up Brantas River', from the Jakarta Post, April 2019 (available online at https://www.thejakartapost.com/news/2019/04/09/developed-countries-urged-to-pick-up-brantas-river-trash.html).

Why do you think the five countries mentioned (including Britain) put their plastic waste into Indonesia's river Brantas?

.....

.....

.....

.....

.....

Do you think the BRACSIP coalition has a case for asking five other countries (including Britain) to pay for the Brantas river plastic clean-up in Indonesia?

.....

.....

.....

.....

.....

.....

.....

.....

Lesson 6:
Approaches to reducing ocean plastic pollution

Different approaches have been put forward to tackle the issue of marine plastic pollution. In this lesson, students engage in a silent debate to evaluate different initiatives.

Resources in this book:


Lesson Overview 6


Teacher Guidance 6


Student Sheet 6a: How can we rethink plastic?

Student Sheet 6b: Plastic bag ban in Kenya

Student Sheet 6c: The Ocean Cleanup

Student Sheet 6d: Plastic straws

Student Sheet 6e: Reusing packaging

Student Sheet 6f: Beach cleanups

Student Sheet 6g: Recycling

Student Sheet 6h: Plastic alternatives

Resources available online:


Slideshow 6: Approaches to reducing ocean plastic pollution

All resources can be downloaded from:
encounteredu.com/teachers/units/ocean-plastics-geography-ages-11-14

LESSON 6

Approaches to reducing ocean plastic pollution

Age 11-14

60 minutes

Curriculum links

- Understand how human processes change landscapes and environments
- Debate solutions to human use of natural resources at a range of scales

Resources

Slideshow 6:
Approaches to reducing ocean plastic pollution

Student Sheet 6a:
How can we rethink plastic to solve the problem of ocean plastics?

Student Sheet 6b:
Plastic bag ban in Kenya

Student Sheet 6c:
The Ocean Cleanup

Student Sheet 6d:
Plastic straws

Student Sheet 6e:
Reusing packaging

Student Sheet 6f:
Beach clean-ups

Student Sheet 6g:
Recycling

Student Sheet 6h:
Reusable alternatives

Lesson overview

Experts agree on the need for urgent action to tackle the issue of marine plastic pollution but disagree on the what methods should be prioritised. Students will look at two main schools of thought: 'turn off the taps', stopping plastic from entering the ocean by reducing plastic pollution, limiting single-use plastic use, improving waste management, and introducing alternative products; and 'bail out the bath', removing plastic waste from the ocean and beaches. Students engage in a silent debate followed by a group discussion to focus on what they believe is the most effective solution.

Lesson steps	Learning outcomes
1. Rethinking the plastic pollution problem (15 mins) Students learn how to categorise proposed solutions to the issue of marine plastics pollution using two frameworks: the 6Rs, and 'turn off the tap' vs 'bail out the bath'.	• Understand the human use of natural resources has caused an environmental situation which needs a solution
2. Plastic solutions silent debate (25 mins) Using a silent debate format, students analyse different proposals to reduce marine plastic pollution, through analysing proposals in more depth and evaluating their strengths and weaknesses.	• Evaluate different solutions to the problems, which work at different scales • Apply skills of data gathering from a number of sources
3. From silent to spoken debate (10 mins) Students move from the silent debate format to a whole class discussion.	• Debate the positive and negative features of each possible solution
4. Plastic solution proposal (10 mins) Students create a table of advantages and disadvantages for each proposed solution. They will need to research and write a short paragraph on their favoured solution. This can be completed for home learning.	• Communicate geographical information through extended writing

TEACHER GUIDANCE 6 (page 1 of 2)
APPROACHES TO REDUCING OCEAN PLASTIC POLLUTION

Step	Guidance	Resources
1 15 mins	In this lesson students will evaluate different approaches to marine plastic pollution. This first lesson step introduces students to two frameworks to group solutions. · Share the learning objectives and connect the learning to the previous lessons on recycling. · Use slide 3 to share the 6Rs with students, ask them if they have heard of these, and whether they can think of any examples. · Slide 4 emphasises the fact that the 6Rs are not in fact six equal options but are ranked in their effectiveness. By the time plastic is being recycled, it has already been created, and referring back to previous lessons, recycling may not be as effective as we might think. · Go over the concepts of 'turn off the tap', 'bail out the bath' and 'mop up the mat' using slide 5. · Hand out Student Sheet 6a and have students read through the information and answer the questions.	**Slideshow 6:** Slides 1-6 **Student Sheet 6a:** How can we rethink plastic to solve the problem of ocean plastics?
2 25 mins	Students engage in a silent debate to evaluate different proposed solutions to marine plastic pollution. Each of the Student Sheets 6b-6h has two sheets: the first with information about a proposed solution and the second with a statement. Place a copy of the info sheet (enlarged to A3 if possible) on separate desks. Stick a copy of the statement sheet in the centre of a large piece of sugar or craft paper. · Students visit various stations in groups of four to five, reading the information, or studying the photos or other data. They do this in silence. · At each station there is a statement with which they may agree or disagree. · Provide students with pens (different colours will allow for tracking of contributions). · Individually they must write a comment on that statement or respectfully add to a statement another student has made. · They may agree or disagree with the main statement or another student's comment. Each statement or enlargement on a statement must be justified and move the discussion forward. · They must not repeat a comment that has been made but they may extend it. · Most stations contain quite a lot of information – teachers may wish to reduce this if younger students are involved or use the material to generate different questions according to ability.	**Slideshow 6:** Slide 7 **Student Sheets 6b-6h**

TEACHER GUIDANCE 6 (page 2 of 2)
APPROACHES TO REDUCING OCEAN PLASTIC POLLUTION

Step	Guidance	Resources
3 10 mins	 Develop the silent debate into a spoken debate. · Once students have completed the silent debate and returned to their seats, show slide 8. · Using the students' answer sheets as stimulus or a selected response from any of the students' thoughts. · A short debate could take place. · Intervene with comments noticed on the papers from usually quiet students.  Silent debates often give quieter/ less confident students a chance to express their own ideas on paper which can be relayed verbally later.	**Slideshow 6:** Slide 8
4 10 mins	 Step 4 asks students to consolidate the silent and spoken debate through extended writing and note-taking. This will also assist with the assessment in the next lesson. Students should complete this activity as part of home learning. · Students create a table of advantages and disadvantages for each of the different approaches. They will be allowed to bring this to the assessment during the next lesson. · They are asked to research and write a short paragraph (not an essay) on the approach they favour ready for an assessment exercise the next lesson. · They must be prepared to justify their answer and say why they have rejected the other options. · Students should have access via the school intranet to the material from the silent debate and hopefully the scanned thoughts from the silent debate.	**Slideshow 6:** Slide 9

How can we rethink plastic to solve the problem of ocean plastics?

World's toughest plastic bag ban

Producing, selling, importing and using plastic bags is now illegal in Kenya, with up to four years jail time or a £31,000 fine.

Improve recycling

UK could adopt strict Norway plastic bottle recycling system. Britain recycles just over 50 % of its plastic bottles, compared to 97% in Norway

Ban plastic straws

McDonalds is to ban plastic straws in all of its UK and Ireland restaurants.

Pitch in with a beach clean up

The National Trust (UK) looks after 780 miles of coastline, providing havens for wildlife and beautiful beaches for everyone to enjoy. If you people want to lend a hand to keep these places special, you can join in with one of the regular beach cleans.

Reuse bottles

With Ecover, you can refill your washing up liquids, laundry liquids and all-purpose cleaners at refill stations across the UK. Their bottles can be used more than 50 times, that's a lot of plastic savings.

Switch out single-use plastics

Marks & Spencer is replacing 75 million pieces of plastic cutlery with alternatives made from FSC certified wood. M&S cafés now serve 99% of their 52 million hot drinks in reusable china.

The Ocean Cleanup

The Ocean Cleanup develops advanced technologies to rid the world's oceans of plastic. A full-scale deployment of the systems is estimated to clean up 50% of the Great Pacific Garbage Patch every 5 years.

Questions

1. Study the approaches to the plastic problem above. Match each of the following words or phrases to at least one of the approaches (the 6Rs): Redesign, Refuse, Reduce, Repair, Reuse, Recycle.

2. Which ones attempt to remove plastic from the ocean and which aim to stop plastic from entering the ocean? Are any difficult to classify? Why?

Plastic bag ban in Kenya

Cyprian Ogoti, a pro-plastic bag ban campaigner photographs plastic pollution to show how it clogs rivers and damages the environment. The Kenya Association of Manufacturers is against the ban claiming it threatens tens of thousands of jobs in Kenya.

The A-One Plastics factory, on the outskirts of Nairobi employs people to recycle plastic. Machines break the plastic down ready for reuse. The company has capacity to recycle 20 to 30 tonnes of plastic waste daily. 15% of this comes from plastic bags.

Photographs courtesy of Nathan Siegel

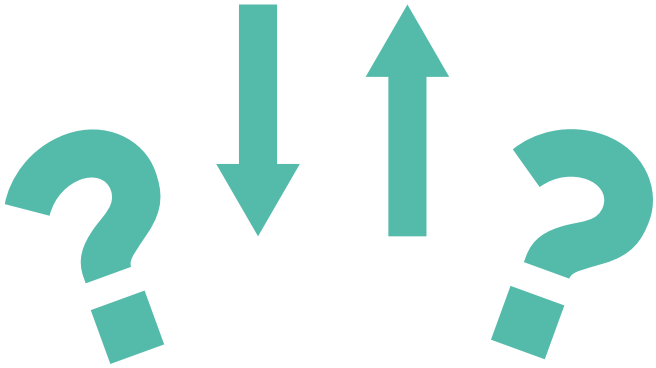
STUDENT SHEET 6b

The Challenge Gift Bags company prints business logos on to paper bags. Its business has grown 10% since the Kenyan plastic bag ban was announced.

The Challenge Gift Bags, workshop is in Kikuyu, a Nairobi suburb 'The company uses surplus paper from larger manufacturers to make 2,000 bags per week. These are sold to hotels and shops.

The Alternative Energy Systems (AES) company near Nairobi employs 700 workers. It processes 12 tonnes of used plastic bags from dumps and supermarkets daily to produce fuel.

The CEO of AES does not expect the plastic bag ban to hurt business because he believes there is enough plastic still in dumps to supply his company for several years.



When plastic items are banned completely there are positive and negative effects, winners and losers.

The Ocean Cleanup

The Ocean Cleanup

The Ocean Cleanup believes it could remove 50% of the Great Pacific Garbage Patch in 5 years.

Combined with land based actions they believe this could produce a plastic free ocean by 2050. “To succeed in our mission, we need to complete one of the most ambitious engineering projects on the face of the planet. Designing mega-structures capable of lasting in the harshest of environments is not easy. Cleaning up 70 % of the world’s surface is even harder, but it is a challenge we are motivated to overcome.”

Boyan Slat, CEO of The Ocean Cleanup, hopes to scoop out the plastic from the ocean before it breaks down using a giant net to form an artificial coastline. He has received crowdfunding and grants to pursue the project.

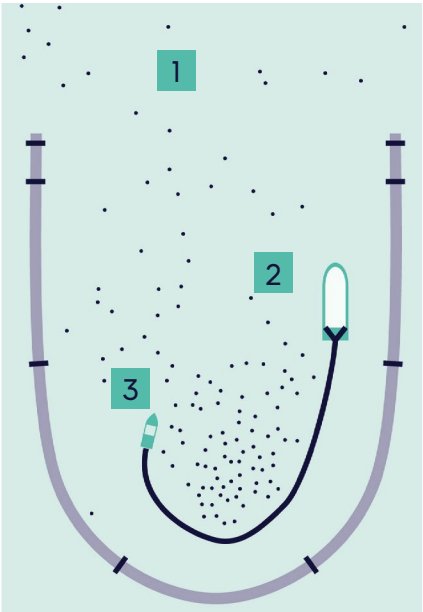
Update December 2018: Due to a structural malfunctioning of the Cleanup system, the team decided to return to port early for repair and assessment

Update April 2019: Relaunch expected in a few months.

1. Plastic debris is carried to the artificial coastline by the ocean currents
2. Plastic is gathered and concentrated
3. Ship removes plastic to land for recycling

“Research shows the majority of plastic by mass is currently in the larger debris. By removing the plastic while most of it is still large, we prevent it from breaking down into dangerous microplastics.”

“The only feasible way to remove plastic from the ocean is to collect it from the shore where the land acts as a natural net”
Scientist critical of Ocean Cleanup



Removing plastic directly from the mid-ocean is so difficult, it's not really worth it.

Plastic straws

The Last Plastic Straw is a project of the Plastic Pollution Coalition.

Did you know? Over 500 million plastic straws are used each day in the United States. In only the past twenty years, people have come to expect plastic straws in every drink, in an example of extreme waste being generated for minimal convenience. These short-lived tools are usually dropped into a garbage can with no further thought, instantly becoming a source of plastic pollution.
https://www.plasticpollutioncoalition.org/no-straw-please/

At the moment, most of the paper straws used in this country are made in China, which obviously isn't great for the carbon footprint. In the UK alone, on average 3.5 million McDonald's customers per day buy a drink with a straw. That means 3.5 million straws a day are discarded just by McDonald's customers. McDonalds signs deal for all UK restaurants to supply paper straws.

London's first paper straw factory has been hailed as a "huge step forward" in the war against single-use plastic has opened for business. It produces biodegradable straws on a specialist machine in its Walthamstow factory. Paper Straws London is one of the first straw making factories in Europe. The paper, glue and ink are all sourced from the UK and Europe, and come in boxes made of recycled card, and cost £3.20 for 250 straws. Paper Straws London hopes to produce one million straws every week to supply London bars, cafés and restaurants. According to Greenpeace, plastic straws are one of the top 10 items found in beach clean ups.

"The plastic ban is imminent," Michael Gove announced on October 22, 2018.

"Following the BBC's Blue Planet series, many businesses are already looking to replace plastic straws with paper ones." Wholesale Manager Feb 2019

Targeting plastic items can damage a country's economy and people.

Reusing packaging

Can I refill my Ecover bottles?

Yes, we believe in reusing before recycling. It's about reusing bottles over and over saving both plastic and pennies, that is why we offer home-refill products in a bag-in-box format, a bit like a wine-box so you can refill at home.

You can refill our Washing Up Liquids, Laundry Liquids and All-Purpose Cleaners at Refill Stations across the UK. Our bottles can be used more than 50 times, that's a lot of plastic savings.

Are glass or plastic bottles better for the environment?

Glass and plastic bottles are similar in price but transporting liquids in glass bottles costs up to 5 times more. A 330ml plastic soft drink bottle contains roughly 18 grams of material while a glass bottle can weigh between 190g and 250g requiring 40% more energy, therefore more CO_2 to transport.

Who should pay for more environmental packaging?

Many companies attempting to reduce plastic waste produced by their products admit it affects profits. Coca-Cola, produces 38,250 tonnes of plastic packaging in the UK each year and sells over 110 billion single-use plastic bottles globally. It has pledged to double the amount of recycled material in its UK plastic bottles and has trialled refillables at Reading University using microchip technology to interact with dispensers on campus. Coca-Cola says these efforts will increase costs.

How would you buy your milk?

80p for two pints in store.

76p for one pint delivered daily.

Reuse is too time consuming and costs money. Single use plastics are better.

Beach clean-ups

Greenpeace Philippines clean-up, name culprits behind plastic pollution in Manila Bay

"Every time a typhoon or monsoon rains come in, Manila Bay spews trash back inland, reminding us of the gravity of the plastic pollution problem in the Philippines."

The Manila City Government and Greenpeace and over 1000 volunteers took part in a clean-up and plastic audit of Manila Bay as part of the Break Free from Plastic initiative.

In the press release, Abigail Aguilar, campaigner for Greenpeace Philippines commented that "Companies must reciprocate and step up in this fight. They are the missing piece in this global action against plastic pollution, and they can do better by reducing their production of single-use plastics."

National Trust's Campaign

The charity looks after more than 1000km of coastline.

It's thanks to the hard working volunteers and ranger teams that help us keep the South West coast looking great, and safe for everyone to enjoy.

People of all ages and abilities can get involved in keeping the coast litter free, what we need are volunteers willing to turn out at their local beach and keep the beach clear. National Trust staff and volunteers do lots of beach cleans, and some visitors help out too. Take part in a beach clean. We regularly run beach clean events, find one near you on our events page.

"There are two pieces of litter for every footstep you take on a beach. The tide of litter on our beaches sadly appears to be on the increase with quantities of litter on UK beaches have more than doubled since 1994. It's estimated that over 100,000 marine animals die every year from entanglement or ingestion of items discarded on our beaches or at sea."

World governments should be responsible for reducing ocean plastic by beach cleaning.

Recycling

Deposit return schemes

Norway's bottle recycling system claims to return 97% of PET bottles for recycling. Bottle manufacturers pay a high tax for each bottle they produce but get a government rebate for each empty container they collect.

Customers pay more for a bottle but get their money back when they put it into a reverse vending machine. Recycling companies collect and processes the bottles to valuable PET flakes.
Norway says recycling bottles is 18% more efficient than reuse.

Germany claims customer deposit and refunds on returned bottles at any supermarket is more successful, but Aldi uses reverse vending machines.

Voluntary action by supermarkets

Proposal by the supermarket Aldi in 2018

- To phase out non-recyclable Black Plastic Food trays, saving 265 tonnes of plastic per year
- Replace trays for fruit and vegetables with clear recycled plastic
- All packaging be recyclable, reusable or compostable by 2025

Mixing up recycling causes issues

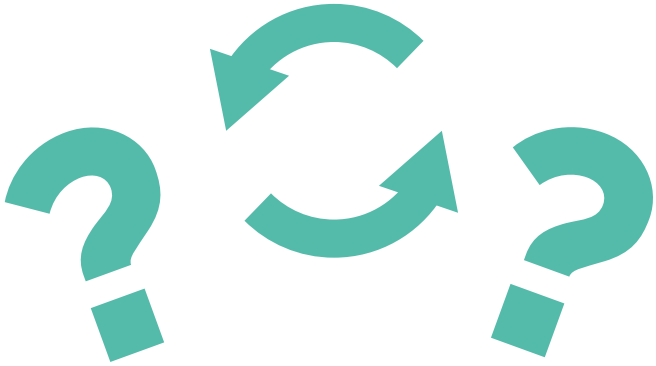
Some multi material items are more complicated and expensive to recycle

Please do not mix biodegradable bags with other plastic as they cannot be recycled together!

#wildbottlesighting

"Our surveys show plastic drinks bottles are frequently among the top four litter items found on UK beaches."

Marine Conservation Society UK



Recycling is the only way forward.

Plastic alternatives

£4.40

Beechwood toothbrush with soft charcoal bristles

£0.85

Supermarket toothbrush made from different plastics

£4.50

Grapefruit & Lime Soap (with exfoliating poppy seeds)

£2.19

Supermarket exfoliating shower gel 250ml

£5 - £25

Water bottles for every taste and pocket, in every colour and price

£0.38

Bottle of supermarket natural mineral water

£30

Reusable wraps made from cotton and beeswax (Lasts about a year)

£1.25

Supermarket clingfilm (25 metre roll)

Plastic alternatives are too expensive to be widely adopted

Lesson 7:
Plastics decision making exercise

A decision-making exercise using information from the silent debate, makes up half of this end of unit assessment.

Resources in this book:

- **Lesson Overview 7**
- **Teacher Guidance 7**
- **Mark Scheme 7a:** Ocean plastics assessment
- **Student Sheet 7a:** Ocean plastics assessment

Resources available online:

- **Slideshow 7:** Plastics decision making exercise

All resources can be downloaded from:
encounteredu.com/teachers/units/ocean-plastics-geography-ages-11-14

Plastics decision making exercise

Age 11-14

60 minutes

Curriculum links

- Understand how human processes change landscapes and environments
- Communicate solutions to human use of natural resources at a range of scales
- Interpret a range of geographical information

Resources

Slideshow 7:
Decision making exercise

Student Sheet 7a:
Ocean plastics assessment

Mark scheme 7a:
Ocean plastics assessment

Lesson overview

Students work through an end of unit assessment that includes short answer questions, data interpretation questions and a decision making exercise. The decision making exercise uses information that students will have gathered during the silent debate in Lesson 6.

Lesson steps

1. **Setting up the assessment (10 mins)**
   Introduce students to the assessment, providing clarity on the mark scheme and displaying the graphs and charts on the board in case these are not clear on the photocopied assessment sheets.

2. **Assessment (40 mins)**
   Students complete the assessment using the information that they gathered during the silent debate and follow-up work to inform the decision making exercise.

3. **Where now? (10 mins)**
   Discuss as a class how new knowledge about a geographical issue can inform action at a range of scales.

Learning outcomes

- Understand the human use of natural resources has caused an environmental situation which needs a solution
- Understand that there are different solutions to the problems, which work at different scales
- Understand that each possible solution has positive and negative features
- Practise skills of data gathering from a number of sources; processing, interpretation, analysis, information communication and extended writing

TEACHER GUIDANCE 7
PLASTICS DECISION MAKING EXERCISE

Step	Guidance	Resources
1 10 mins	In this lesson students will complete their end of unit assessment, comprising short answer questions, data analysis and a decision making exercise. Students should use the information they developed during the silent debate exercise in Lesson 6 to inform their answers to the decision making exercise. · Share the assessment objectives and ensure students have access to their work from Lesson 6. · Go through the mark scheme summary on slide 3 and share the information on Mark Scheme 7a if this is your usual practice for assessments. · Hand out copies of Student Sheet 7a, one per student and review the instructions. · Show the graphs on slides 4 and 5 in case these are difficult to see on photocopies.	**Slideshow 7:** Slides 1-5 **Mark Scheme 7a** Ocean plastics assessment **Student Sheet 7a** Ocean plastics assessment
2 40 mins	Students complete the assessment. · Give students 40 minutes to complete the assessment on Student Sheet 7a, using the information they gathered during Lesson 6 for the decision making exercise. · Leave the diagrams showing to add clarity for answering the data analysis questions.	**Slideshow 7:** Slides 4-5 **Student Sheet 7a** Ocean plastics assessment
3 10 mins	With the formal learning of the unit completed, students can turn their knowledge into practice through the fieldwork suggested in Lesson 8 (school grounds option) or Lesson 9 (local area option). · Use this lesson step to connect knowledge to practice, either through introducing the fieldwork phase or through a whole class discussion. · Prompts for an end of unit whole class discussion could include: · What did you learn that had the most impact on you? · How do you think what you learned will change your behaviour? · What will you do differently having completed this unit? · How could you take your new knowledge of plastics to change how you behave? · How do you think that school policies or practice could change to reflect what you have learned? · The lesson could end with students taking a pledge to take action on plastic.	**Slideshow 7:** Slide 6

Ocean plastics assessment

Assessment Objectives

AO1 Demonstrate knowledge of locations, places, processes, environments and different scales.

AO2 Demonstrate geographical understanding of concepts and how they are used in relation to places, environments and processes, and the inter-relationships between places, environments and processes.

AO3 Apply knowledge and understanding to interpret, analyse and evaluate geographical information and issues and to make judgements.

AO4 Select, adapt and use a variety of skills and techniques to investigate questions and issues and communicate findings.

Short answer questions - 16 marks

Question	Answer	Mark	Objective
1	Converting plastic waste into new materials	1 mark	AO1
2	Recycle	1 mark	AO1
3	Reuse	1 mark	AO1
4	Any two of: financial incentives, fines / financial penalties, imprisonment.	2 marks	AO2
5	List the rivers and amount in tonnes contributed by rivers in China or the overall amount of plastic pollution contributed by all the listed rivers in China. Hanjiang (12,900), Zhujiang (13,600), Dong, (19,100), Huangqu (40,800), Xi (73,900), Yangtze (333,000). Total for rivers listed in China is 493,300 tonnes. The Mekong has not been included as only its upper reaches are in China, but do not penalise students who include it. Students may also note that Chinese rivers are major contributors of plastic pollution, but for 2 marks, they will need to use figures.	2 marks	AO4
6	All the countries named are described as developing nations, with the majority of countries named being in Asia (15 out of 20).	1 mark	AO1
7	The UK and many other countries used to send their rubbish to China and many other countries in Asia. The countries listed are often described as being 'developing' nations, this could mean rubbish collection and infrastructure is limited, meaning rivers and other water ways are often used as a way of disposing of rubbish.	2 marks	AO3

MARK SCHEME 7a

Question	Answer	Mark	Objective
8	210 million tonnes	1 mark	AO1
9	Plastic produced in 2000 was approximately 215 million tonnes and plastic discarded in 2000 was approximately 165 million tonnes. 165/215 = 77% of all plastic produced in 2000 was discarded.	1 mark	AO4
10	Between 1950 and 2015 the amount of plastic recycled has increased. That increase has only been since early 2000.	1 mark	AO4
11	Plastic production in 1980 was approximately 70 million tonnes. Plastic production in 2015 was 380 million tonnes	1 mark	AO4
12	It began after 1945 and continues today. It is getting worse and worse over this long time period.	2 marks	AO3

Decision making exercise - 16 marks

Question	Answer	Mark	Objective
Box 1	Clear description of how the chosen option works.	2 marks	AO2
	Includes a named example	1 mark	AO1
Box 2	Lists two appropriate reasons.	2 marks	AO2
	Explains two benefits.	2 marks	AO2
Box 3	Lists two problems or disadvantages.	2 marks	AO2
Box 4	Lists two other options and appropriate disadvantages per option.	2 marks	AO2
Box 5	Includes an appropriate named example.	1 mark	AO1
Box 6	List one appropriate advantage of each option.	2 marks	AO2
	Explain with appropriate reasons why these two options were rejected.	2 marks	AO3
Total		**32 marks (SPG: 1 mark)**	

Ocean plastics assessment

Use the options table and any information given here to help you complete the tasks.

Six ways of reducing the plastic pollution problem include:

Redesign	Refuse	Reduce	Repair	Reuse	Recycle

1. What does it mean to recycle plastic waste?

[1]

2. 'Ecover launches bottle made from 50% ocean plastic' Which of the six Rs mentioned above is this an example of?

[1]

3. You decide to bring a refillable water bottle to school. Which of the six Rs is this describing?

[1]

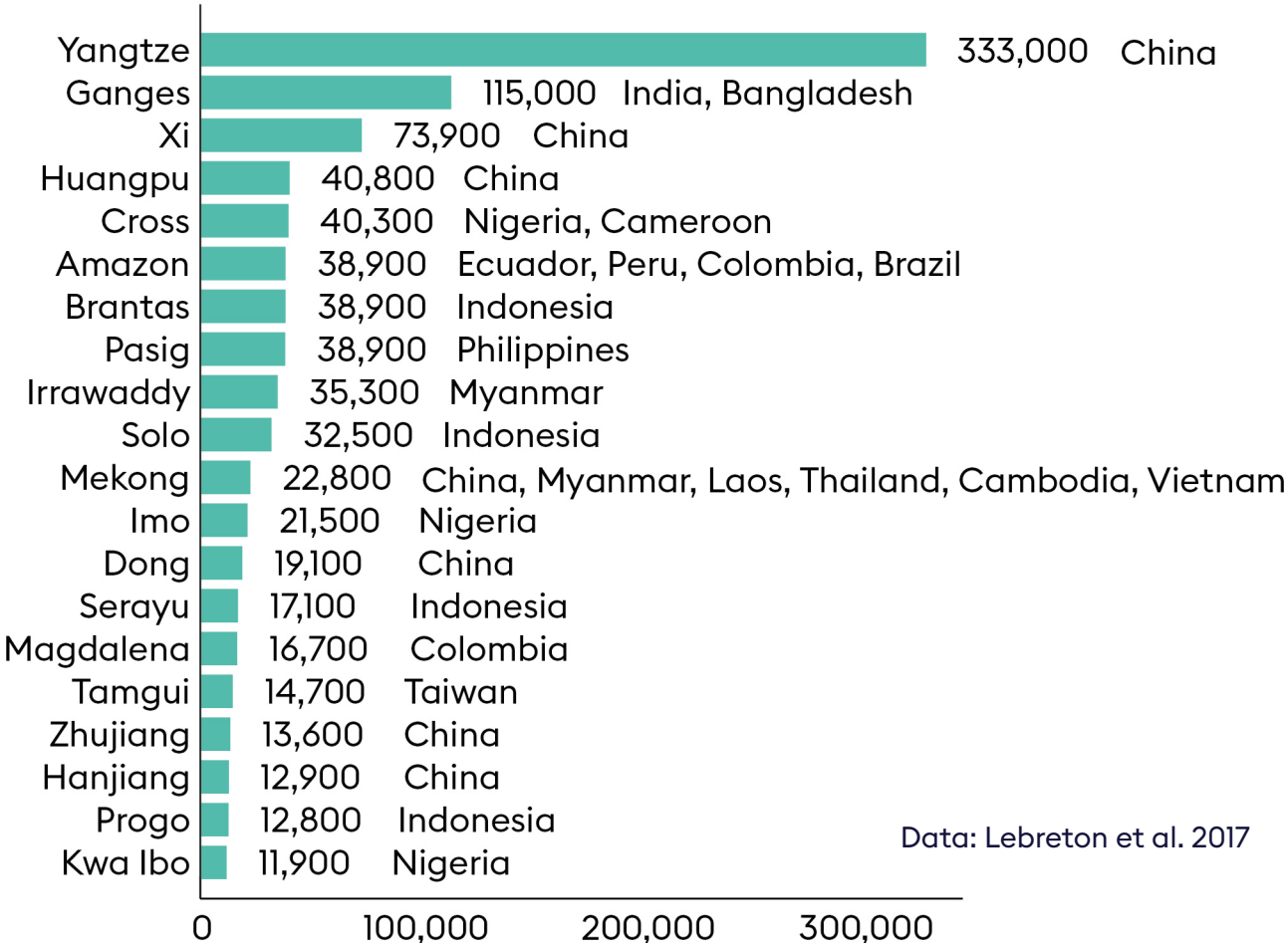
4. Kenya has a ban on plastic bags. Suggest two ways the ban could be enforced?

[2]

Study the graph below and use it to answer the following questions.

Top 20 rivers for plastic input to the ocean (2015)

Plastic input to the ocean from the top 20 polluting rivers across the world. Shown is the river, its location and estimated annual input of plastic into the oceans in tonnes.



Data: Lebreton et al. 2017

5. Describe the amount of plastic that polluted the ocean from rivers in China.

[2]

6. Identify any patterns in the data.

[1]

7. What factors contribute to the levels of plastic pollution in these rivers?

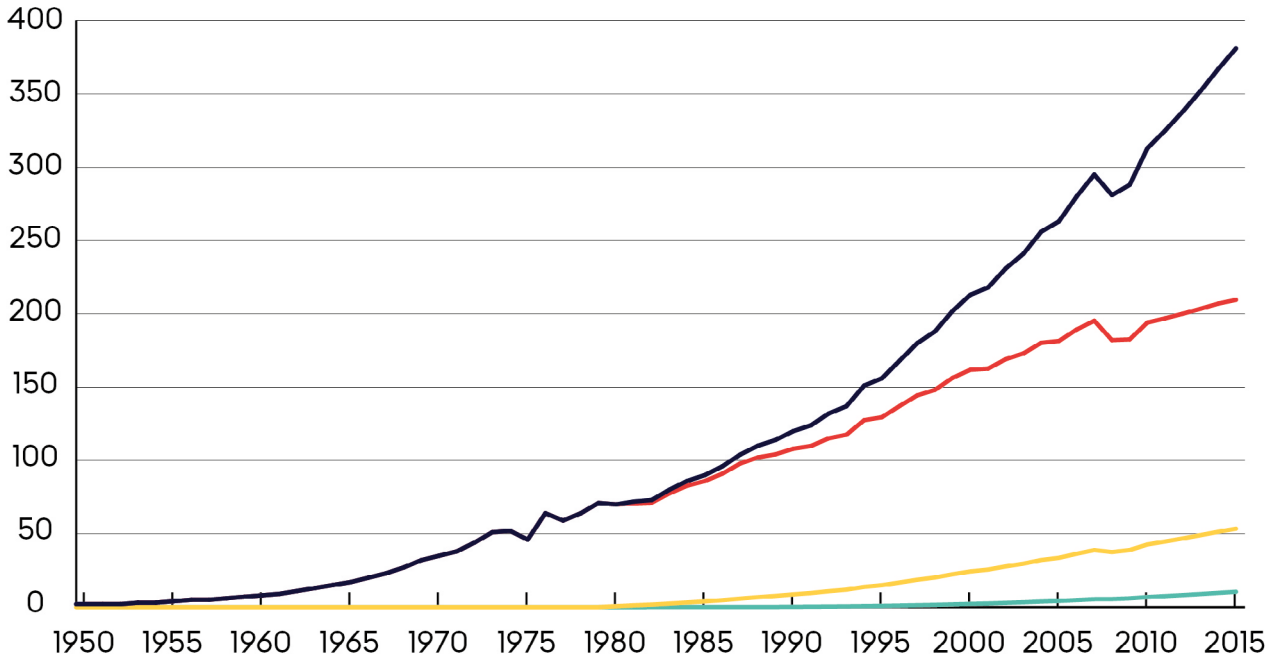
[2]

Study the graph below and use it to answer the following questions.

Fate of all plastic produced between 1950-2015 in millions of tonnes (Mt)

produced discarded incinerated recycled

Data: Geyer, Jambeck & Law (2017)



8. How much plastic was discarded in 2015?

[1]

9. What percentage of plastic produced in 2000 was discarded?

[1]

10. Describe what has happened to the amount of plastic recycled between 1950 and 2015.

[1]

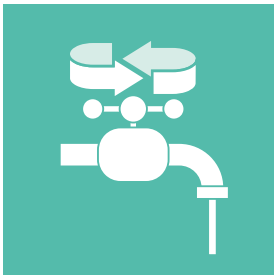
11. How much has plastic production increased since 1980?

[1]

12. Plastic pollution has been called 'The Long Emergency'. Suggest why it has been given this name.

[2]

Decision-making exercise on the options to deal with plastic pollution



Turn off the taps

Bail out the bath

Do nothing

Choose the option that you think is the most effective to deal with Plastic pollution. Use examples and details from your 'Silent Debate' table and any extra detail you have found out.

My Chosen Plan: .....

Plan	Your writing here
Explain with an example how this option works.	[3]
Give two reasons for choosing this option, and explain the benefits it brings.	[4]

Plan	Your writing here
Suggest two problems or disadvantages of your choice.	[2]
Think of the other two options and give two disadvantages they have.	[2]
Give an example for at least one of these two options.	[1]
Suggest an advantage of each of these options. Say why you rejected each of the other options.	[4]

Lesson 8:
Plastics fieldwork (school grounds)

This lesson provides a framework for conducting plastics fieldwork in the school grounds. An alternative, Lesson 9, provides an option for taking this fieldwork into the local area.

Resources in this book:


Lesson Overview 8


Teacher Guidance 8


Student Sheet 8a: Plastics fieldwork record sheet

Student Sheet 8b: Plastics fieldwork report frame

Student Sheet 8c: Plastics fieldwork evaluation

Resources available online:


Slideshow 8: Plastics fieldwork (school grounds)

All resources can be downloaded from:
encounteredu.com/teachers/units/ocean-plastics-geography-ages-11-14

Plastics fieldwork (school grounds)

Age 11-14

180 minutes

Curriculum links

- Plan and conduct fieldwork safely and effectively
- Present data collected on fieldwork and draw conclusions
- Propose changes to improve the environment based on evidence gathered during fieldwork

Resources

Slideshow 8: Plastics fieldwork (school grounds)

Student Sheet 8a: Plastics fieldwork record sheet

Student Sheet 8b: Plastics fieldwork report frame

Student Sheet 8c: Plastics fieldwork evaluation

Lesson overview

This lesson provides a framework for conducting plastics fieldwork in the school grounds. As per most fieldwork, it consists of three phases: preparation, conducting fieldwork, and then analysis and conclusions. Depending on your school timetable and ability of your class, you will need to set aside three to four hours to complete this fieldwork activity. Suggestions for challenge tasks are included for more able students, if you teach a mixed ability class.

Lesson steps	Learning outcomes
1. Focus of the fieldwork (15 mins) Introduce the fieldwork topic and the geographical enquiry cycle. Students will consider their fieldwork on plastics in the school grounds and place this in context of their learning on ocean plastics.	• Plan fieldwork including risk assessment
2. Evaluating environmental quality (15 mins) Students will be assessing the environmental quality of different sites across the school grounds. During this lesson step, students will decide on the criteria that should make up an environmental quality score.	• Plan and carry out data collection
3. Fieldwork methodology (15 mins) Students decide on the methodology they will use for their data collection and complete the introduction and methodology sections of their fieldwork report.	• Plan and carry out data collection
4. Risk assessment (15 mins) Introduce students to the need for risk assessments and ask them to conduct a risk assessment for their school grounds fieldwork.	• Plan fieldwork including risk assessment

Plastics fieldwork (school grounds)

Age 11-14

180 minutes

Lesson steps	Learning outcomes
5. Conduct fieldwork (60 mins) Students conduct the fieldwork, recording data for all sites using their fieldwork record sheets and through photography.	• Plan and carry out data collection
6. Analyse data (30 mins) On returning to the classroom, students analyse their data using tables, charts and maps. These will form part of the overall fieldwork report.	• Represent data using tables, charts and maps
7. Draw conclusions (20 mins) Students draw conclusions from their data and evaluate their fieldwork methods. They will also develop suggestions for improving the environmental quality of sites in the school grounds.	• Analyse fieldwork data and draw conclusions • Evaluate fieldwork methods and results
8. Focus for change (10 mins) Students share ideas for improving the school grounds. Common themes and ideas can be presented to school management for implementation.	• Suggest ways of improving the area in terms of reducing plastic pollution

TEACHER GUIDANCE 8 (page 1 of 3)
PLASTICS FIELDWORK (SCHOOL GROUNDS)

Step	Guidance	Resources
1 15 mins	In this mini-fieldwork project, students will work together to conduct fieldwork on plastics in their school grounds. The fieldwork is split into three sections: preparation lesson (approx. 1 hour), conducting fieldwork (approx. 1 hour), and data analysis and conclusions (approx. 1-2 hours). This teacher guidance covers the entire 3-4 hours. · Share the learning objectives for the school grounds fieldwork. · Using slide 3, introduce the idea of the geographical enquiry cycle. This will be referred to throughout. · Using slide 4, share the geographical fieldwork enquiry cycle with students. Although students will only be conducting one cycle of fieldwork, by the end of the project, they will be able to see how continuous investigation is possible. · Using slides 5-7, connect the fieldwork to previous learning on plastics, and show how the theory lessons covered connect to students' own enquiry in the school grounds. · Use slide 8 to refresh students' ideas about how fieldwork can be conducted. Students may draw from their own personal experience or what they have studied in other units or seen in the media.	**Slideshow 8:** Slides 1-8
2 15 mins	Students start to consider how they will carry out their fieldwork. The first item to consider is how to calculate the environmental quality of a site. · Slide 9 frames the idea of environmental quality. · Slide 10 refers this concept back to the school grounds. Ask students to select criteria to use for assessing in pairs using slide 11. · Students should add these criteria to Student Sheet 8a, and then practise applying them using the photographs from the school grounds. · Share students' thoughts using a mini-plenary, before sharing the fieldwork sample sites on slide 14.	**Slideshow 8:** Slides 9-14 **Student Sheet 8a:** Plastics fieldwork record sheet **Student Sheet 8b:** Plastics fieldwork report frame

This section of the fieldwork will require students to reflect on photos from their school grounds. You will need to have taken these and inserted them into the slideshow in advance of the lesson. On slide 14, you will also need to insert a map of the school grounds and mark the fieldwork sites for data collection. Digital mapping sites such as Google Maps and OpenStreetMap can be used, with an annotated screenshot added to the slideshow.

Step	Guidance	Resources
3 15 mins	Students start to develop the methodology for their fieldwork and complete the first sections of their fieldwork report. · Refer back to the fieldwork enquiry cycle on slide 15. · Frame the data collection activity (i.e. the fieldwork) using slide 16. Ask students to follow the instructions on this slide, discussing in pairs how they propose to collect the data for their fieldwork. This can then be shared in a group of four. · Slide 17 refers to the structure of the data collection on Student Sheet 8a. · Slide 18 consolidates this planning and methodology stage of the fieldwork. · Hand out copies of Student Sheet 8b and ask students to complete sections 1 and 2 of their fieldwork reports. Model answers have been provided as a precursor to students having to describe fieldwork methods at GCSE.	**Slideshow 8:** Slides 15-18 **Student Sheet 8a:** Plastics fieldwork record sheet **Student Sheet 8b:** Plastics fieldwork report frame
4 15 mins	Students will need to think about the risks they may face during the fieldwork and the actions that they can take to address these. · Show students the annotated photograph on slide 19 and ask for further examples from their own school grounds, along with ideas for how these risks can be mitigated. · Consolidate the preparation steps, making sure that student groups are ready to conduct the data collection. · Using slide 20, use prompt questions to test student understanding of the plastics fieldwork project. These may include: · What is the aim of the fieldwork? · How will you collect the data? · What do we mean by environmental quality? · What are the risks involved in carrying out fieldwork in the school grounds? · How can we avoid some of these risks?	**Slideshow 8:** Slides 19-20

As an extension for this lesson step, consider using some of the galleries on the Encounter Edu website that show more extreme fieldwork and think about the hazards, risks and control measure that might be needed. As potential geography researchers, this may help to show students where geography can take them.

This risk assessment exercise is not a substitute for this fieldwork being risk assessed by a qualified individual following school guidelines.

TEACHER GUIDANCE 8 (page 3 of 3)
PLASTICS FIELDWORK (SCHOOL GROUNDS)

Step	Guidance	Resources
5 60 mins	This lesson step represents the fieldwork. · Connect students to the preparation lesson, remembering to go over the data collection aspect and making sure that each student group has enough copies of Student Sheet 8a. · Review the areas for the students to visit. · Students carry out their fieldwork by visiting the sample sites and recording the data. · Students return to the classroom with their fieldwork record sheets complete. Remember to add any briefing notes to this stage of the fieldwork that are noted in your risk assessment. These may include notes about hazards identified, environmental conditions, behaviour expectations, etc.	**Slideshow 8:** Slide 20 **Student Sheet 8a:** Plastics fieldwork record sheet
6 30 mins	On their return to the classroom, students present and analyse the data they collected during the fieldwork phase. · Review the data presentation activities on slide 22. These are also repeated on Student Sheet 8b. · Ensure that student groups know how to complete these tasks and what success looks like. · Hand out graph paper and photocopies of a map of the school grounds as necessary. · Students who complete the three compulsory activities can be challenged to complete some of the optional activities. · Students should also complete the data analysis section of their reports.	**Slideshow 8:** Slides 21-27 **Student Sheet 8b:** Plastics fieldwork report frame
7 20 mins	Students draw conclusions from their data and answer the questions in the conclusion section of their report. · Students use the framework provided on Student Sheet 8c. Students may need longer to complete their reports and an additional lesson or home learning time can be assigned to this.	**Slideshow 8:** Slides 28-30 **Student Sheet 8c:** Plastics fieldwork evaluation
8 10 mins	Students share their ideas for improving the school grounds. · Ask students to share their ideas for improving the grounds and through a whole class discussion take forward ideas to be presented to school management.	**Slideshow 8:** Slide 30

STUDENT SHEET 8a

Plastics fieldwork record sheet

Fieldwork activity

1. Complete an environmental quality survey of each site.
2. Record the types of litter and types of plastic pollution.

Site:

Category	5 Excellent	4	3 Average	2	1 Poor
Overall					

Types of litter	Amount of litter (tally)
•	
•	
•	
•	
•	

Site:

Category	5 Excellent	4	3 Average	2	1 Poor
Overall					

Types of litter	Amount of litter (tally)
•	
•	
•	
•	
•	

STUDENT SHEET 8b

Plastics fieldwork report frame

For your plastics fieldwork, you will need to produce a report. You will be provided with additional materials to present this in your exercise books or on separate paper.

A report for fieldwork has five sections

Introduction

The introduction provides an overview of the topic you are studying.

Methodology

This section describes the way that you carried out your fieldwork.

Data presentation

Present the information that you gathered on your fieldwork using a combination of tables, graphs, charts, maps and photos.

Data analysis

Analyse the data you have gathered and describe any patterns that you have discovered.

Conclusion

Present conclusions based on your analysis, including proposals for any actions that could be taken based on your analysis. You can also reflect on what went well and what could be improved.

Introduction

Write your own or use the model introduction below.

We are investigating the level of plastic pollution and how it affects the environmental quality of our school grounds. Plastic pollution is a serious issue affecting environmental and human health. By collecting data and analysing it, we will present ideas for reducing the amount of plastic pollution in our school grounds.

You may also want to include some facts on the scale of the plastic pollution problem, e.g. over 200 million tonnes of plastic was discarded in 2015.

Methodology

Write your own or use the model methodology below.

To assess the level of plastic pollution and environmental quality in the school grounds, we visited five [change as appropriate] sites. At each site, we counted the amount of litter, and categorised these items of litter as plastic and non-plastic. We also gave each site an environmental quality score.

This score was made up of different factors that we selected before we conducted the fieldwork. We chose cleanliness, peacefulness, and the amount of greenery [change these as appropriate]. We also took photographs at each site, so that we had a visual record of what the data actually looked like.

You may also want to include an example of your data record sheet.

Data presentation

For the data presentation, you will need to complete the three compulsory activities. As a challenge, you can also select from the optional data presentation activities.

Compulsory activities

- Create a table that ranks environmental quality of the sites from best to worst.
- Draw a clustered block chart that shows the number of plastic and non-plastic items of litter for each site.
- Create a map of the grounds, with each sample site marked, and using a key show the level of litter for each site. Add a scale and orientation as a bonus.

Optional activities

- Create a pie chart to show the overall proportion of plastic vs non-plastic litter found in the school grounds.
- Choose a graph format to show the relationship between environmental quality and number of litter items.
- Choose a graph format to show the relationship between number of litter items and sources of litter (e.g. canteen, vending machine, kiosk, etc.).
- Consider other formats to represent data that may communicate the issue of plastic pollution better such as a pictograph.
- Choose how to add photos to your data presentation to bring it to life.

Data analysis

Answer the following questions to provide an analysis of your data.

- Is there a pattern as to where the best and worst sites are for environmental quality and plastic pollution? (one sentence)
- What is the pattern? (two sentences)
- How can the pattern be explained? (three sentences)

Conclusion

Use the framework on Student Sheet 8b to complete your conclusion.

Plastics fieldwork evaluation

How to improve your chosen place

Site:

Improvements	Reasons for improvements
•	•
•	•
•	•
•	•

How well did we work together?

Very well	**Fairly well**
Poorly	**Badly**

What went well?

What was difficult?

Lesson 9:
Plastics fieldwork (local area)

This lesson provides a framework for conducting plastics fieldwork in the local area. An alternative, Lesson 8, provides an option for running this fieldwork in the school grounds.

Resources in this book:

Lesson Overview 9

Teacher Guidance 9

Student Sheet 9a: Plastics fieldwork record sheet

Student Sheet 9b: Plastics fieldwork report frame

Student Sheet 9c: Plastics fieldwork evaluation

Resources available online:

Slideshow 9: Plastics fieldwork (local area)

All resources can be downloaded from:
encounteredu.com/teachers/units/ocean-plastics-geography-ages-11-14

Plastics fieldwork (local area)

Age 11-14

180 minutes

Curriculum links

- Plan and conduct fieldwork safely and effectively
- Present data collected on fieldwork and draw conclusions
- Propose changes to improve the environment based on evidence gathered during fieldwork

Resources

Slideshow 9: Plastics fieldwork (local area)

Student Sheet 9a: Plastics fieldwork record sheet

Student Sheet 9b: Plastics fieldwork report frame

Student Sheet 9c: Plastics fieldwork evaluation

Lesson overview

This lesson provides a framework for conducting plastics fieldwork in the local area. As per most fieldwork, it consists of three phases: preparation, conducting fieldwork, and then analysis and conclusions. Depending on your school timetable and ability of your class, you will need to set aside three to four hours to complete this fieldwork activity. Suggestions for challenge tasks are included for more able students, if you teach a mixed ability class.

Lesson steps	Learning outcomes
1. Focus of the fieldwork (15 mins) Introduce the fieldwork topic and the geographical enquiry cycle. Students will consider their fieldwork on plastics in the local area and place this in context of their learning on ocean plastics.	• Plan fieldwork including risk assessment
2. Evaluating environmental quality (15 mins) Students will be assessing the environmental quality of different sites across the local area. During this lesson step, students will decide on the criteria that should make up an environmental quality score.	• Plan and carry out data collection
3. Fieldwork methodology (15 mins) Students decide on the methodology they will use for their data collection and complete the introduction and methodology sections of their fieldwork report.	• Plan and carry out data collection
4. Risk assessment (15 mins) Introduce students to the need for risk assessments and ask them to conduct a risk assessment for their local area fieldwork.	• Plan fieldwork including risk assessment

Plastics fieldwork (local area)

Age 11-14

180 minutes

Lesson steps	Learning outcomes
5. Conduct fieldwork (60 mins) Students conduct the fieldwork, recording data for all sites using their fieldwork record sheets and through photography.	• Plan and carry out data collection
6. Analyse data (30 mins) On returning to the classroom, students analyse their data using tables, charts and maps. These will form part of the overall fieldwork report.	• Represent data using tables, charts and maps
7. Draw conclusions (20 mins) Students draw conclusions from their data and evaluate their fieldwork methods. They will also develop suggestions for improving the environmental quality of sites in the local area.	• Analyse fieldwork data and draw conclusions • Evaluate fieldwork methods and results
8. Focus for change (10 mins) Students share ideas for improving the local area. Common themes and ideas can be presented to school management for implementation.	• Suggest ways of improving the area in terms of reducing plastic pollution

TEACHER GUIDANCE 9 (page 1 of 3)
PLASTICS FIELDWORK (LOCAL AREA)

Step	Guidance	Resources
1 15 mins	In this mini-fieldwork project, students will work together to conduct fieldwork on plastics in their local area. The fieldwork is split into three sections: preparation lesson (approx. 1 hour), conducting fieldwork (approx. 1 hour), and data analysis and conclusions (approx. 1-2 hours). This teacher guidance covers the entire 3-4 hours. · Share the learning objectives for the local area fieldwork. · Using slide 3, introduce the idea of the geographical enquiry cycle. This will be referred to throughout. · Using slide 4, share the geographical fieldwork enquiry cycle with students. Although students will only be conducting one cycle of fieldwork, by the end of the project, they will be able to see how continuous investigation is possible. · Using slides 5-7, connect the fieldwork to previous learning on plastics, and show how the theory lessons covered connect to students' own enquiry in the local area. · Use slide 8 to refresh students' ideas about how fieldwork can be conducted. Students may draw from their own personal experience or what they have studied in other units or seen in the media.	**Slideshow 9:** Slides 1-8
2 15 mins	Students start to consider how they will carry out their fieldwork. The first are to consider is how to calculate the environmental quality of a site. · Slide 9 frames the idea of environmental quality. · Slide 10 refers this concept back to the local area. Ask students to select criteria to use for assessing in pairs using slide 11. · Students should add these criteria to Student Sheet 9a, and then practise applying them using the photographs from the local area. · Share students' thoughts using a mini-plenary, before sharing the fieldwork sample sites on slide 14.	**Slideshow 9:** Slides 9-14 **Student Sheet 9a:** Plastics fieldwork record sheet **Student Sheet 9b:** Plastics fieldwork report frame

This section of the fieldwork will require students to reflect on photos from their local area. You will need to have taken these and inserted them into the slideshow in advance of the lesson. On slide 14, you will also need to insert a map of the local area and mark the fieldwork sites for data collection. Digital mapping sites such as Google Maps and OpenStreetMap can be used, with an annotated screenshot added to the slideshow.

Step	Guidance	Resources
3 15 mins	Students start to develop the methodology for their fieldwork and complete the first sections of their fieldwork report. · Refer back to the fieldwork enquiry cycle on slide 15. · Frame the data collection activity (i.e. the fieldwork) using slide 16. Ask students to follow the instructions on this slide, discussing in pairs how they propose to collect the data for their fieldwork. This can then be shared in a group of four. · Slide 17 refers to the structure of the data collection on Student Sheet 9b. · Slide 18 consolidates this planning and methodology stage of the fieldwork. · Hand out copies of Student Sheet 9a and ask students to complete sections 1 and 2 of their fieldwork reports. Model answers have been provided as a precursor to students having to describe fieldwork methods at GCSE.	**Slideshow 9:** Slides 15-18 **Student Sheet 9a:** Plastics fieldwork record sheet **Student Sheet 9b:** Plastics fieldwork report frame
4 15 mins	Students will need to think about the risks they may face during the fieldwork and the actions that they can take to address these. · Show students the annotated photograph on slide 19 and ask for further examples from their own local area, along with ideas for how these risks can be mitigated. · Consolidate the preparation steps, making sure that student groups are ready to conduct the data collection. · Using slide 20, use prompt questions to test student understanding of the plastics fieldwork project. These may include: · What is the aim of the fieldwork? · How will you collect the data? · What do we mean by environmental quality? · What are the risks involved in carrying out fieldwork in the local area? · How can we avoid some of these risks?	**Slideshow 9:** Slides 19-20
	As an extension for this lesson step, consider using some of the galleries on the Encounter Edu website that show more extreme fieldwork and think about the hazards, risks and control measure that might be needed. As potential geography researchers, this may help to show students where geography can take them. This risk assessment exercise is not a substitute for this fieldwork being risk assessed by a qualified individual following school guidelines.	

TEACHER GUIDANCE 9 (page 3 of 3)
PLASTICS FIELDWORK (LOCAL AREA)

Step	Guidance	Resources
5 60 mins	 This lesson step represents the fieldwork. · Connect students to the preparation lesson, remembering to go over the data collection aspect and making sure that each student group has enough copies of Student Sheet 9b. · Review the areas for the students to visit. · Students carry out their fieldwork by visiting the sample sites and recording the data. · Students return to the classroom with their fieldwork record sheets complete.  Remember to add any briefing notes to this stage of the fieldwork that are noted in your risk assessment. These may include notes about hazards identified, environmental conditions, behaviour expectations, etc.	**Slideshow 9:** Slide 20 **Student Sheet 9a:** Plastics fieldwork record sheet
6 30 mins	 On their return to the classroom, students present and analyse the data they collected during the fieldwork phase. · Review the data presentation activities on slide 22. These are also repeated on Student Sheet 9a. · Ensure that student groups know how to complete these tasks and what success looks like. · Hand out graph paper and photocopies of a map of the local area as necessary. · Students who complete the three compulsory activities can be challenged to complete some of the optional activities. · Students should also complete the data analysis section of their reports.	**Slideshow 9:** Slide 21-27 **Student Sheet 9b:** Plastics fieldwork report frame
7 20 mins	 Students draw conclusions from their data and answer the questions in the conclusion section of their report. · Students use the framework provided on Student Sheet 9c.  Students may need longer to complete their reports and an additional lesson or home learning time can be assigned to this.	**Slideshow 9:** Slides 28-30 **Student Sheet 9b:** Plastics fieldwork report frame **Student Sheet 9c:** Plastics fieldwork evaluation
8 10 mins	 Students share their ideas for improving the local area. · Ask students to share their ideas for improving the local area and through a whole class discussion take forward ideas to be presented to school management.	**Slideshow 9:** Slide 30

STUDENT SHEET 9a

Plastics fieldwork record sheet

Fieldwork activity

1. Complete an environmental quality survey of each site.
2. Record the types of litter and types of plastic pollution.

Site:

Category	5 Excellent	4	3 Average	2	1 Poor
Overall					

Types of litter	Amount of litter (tally)
•	
•	
•	
•	
•	

Site:

Category	5 Excellent	4	3 Average	2	1 Poor
Overall					

Types of litter	Amount of litter (tally)
•	
•	
•	
•	
•	

STUDENT SHEET 9b

Plastics fieldwork report frame

For your plastics fieldwork, you will need to produce a report. You will be provided with additional materials to present this in your exercise books or on separate paper.

A report for fieldwork has five sections

Introduction

The introduction provides an overview of the topic you are studying.

Methodology

This section describes the way that you carried out your fieldwork.

Data presentation

Present the information that you gathered on your fieldwork using a combination of tables, graphs, charts, maps and photos.

Data analysis

Analyse the data you have gathered and describe any patterns that you have discovered.

Conclusion

Present conclusions based on your analysis, including proposals for any actions that could be taken based on your analysis. You can also reflect on what went well and what could be improved.

Introduction

Write your own or use the model introduction below.

We are investigating the level of plastic pollution and how it affects the environmental quality of our local area. Plastic pollution is a serious issue affecting environmental and human health. By collecting data and analysing it, we will present ideas for reducing the amount of plastic pollution in our local area.

You may also want to include some facts on the scale of the plastic pollution problem, e.g. over 200 million tonnes of plastic was discarded in 2015.

Methodology

Write your own or use the model methodology below.

To assess the level of plastic pollution and environmental quality in the local area, we visited five [change as appropriate] sites. At each site, we counted the amount of litter, and categorised these items of litter as plastic and non-plastic. We also gave each site an environmental quality score.

This score was made up of different factors that we selected before we conducted the fieldwork. We chose cleanliness, peacefulness, and the amount of greenery [change these as appropriate]. We also took photographs at each site, so that we had a visual record of what the data actually looked like.

You may also want to include an example of your data record sheet.

Data presentation

For the data presentation, you will need to complete the three compulsory activities. As a challenge, you can also select from the optional data presentation activities.

Compulsory activities

- Create a table that ranks environmental quality of the sites from best to worst.
- Draw a clustered block chart that shows the number of plastic and non-plastic items of litter for each site.
- Create a map of the area, with each sample site marked, and using a key show the level of litter for each site. Add a scale and orientation as a bonus.

Optional activities

- Create a pie chart to show the overall proportion of plastic vs non-plastic litter found in the local area.
- Choose a graph format to show the relationship between environmental quality and number of litter items.
- Choose a graph format to show the relationship between number of litter items and sources of litter (e.g. canteen, vending machine, kiosk, etc.).
- Consider other formats to represent data that may communicate the issue of plastic pollution better such as a pictograph.
- Choose how to add photos to your data presentation to bring it to life.

Data analysis

Answer the following questions to provide an analysis of your data.

- Is there a pattern as to where the best and worst sites are for environmental quality and plastic pollution? (one sentence)
- What is the pattern? (two sentences)
- How can the pattern be explained? (three sentences)

Conclusion

Use the framework on Student Sheet 9b to complete your conclusion.

Plastics fieldwork evaluation

How to improve your chosen place

Site:

Improvements	Reasons for improvements
•	•
•	•
•	•
•	•

How well did we work together?

Very well	**Fairly well**
Poorly	**Badly**

What went well?

What was difficult?

This book and associated resources can be accessed from encounteredu.com/teachers/units/ocean-plastics-geography-ages-11-14

- Videos and interactive diagrams
- Individual lesson and resource downloads
- Live broadcasts with scientists and innovators
- Subject Updates and training courses

Other books in this series

Ocean Plastics X-Curric 5-7

Ocean Plastics X-Curric 7-11

Ocean Plastics Science 11-14

Ocean Plastics D&T 11-14

Photo credits

Cover	Plastic: Bigstock Gyres: NASA
Student Sheet 1a	Plastic accumulation: The Ocean Cleanup
Student Sheet 1b	Foggy sea: Pexels
Student Sheet 1c	Ocean currents: NASA
Student Sheet 1d	Rubber duck: Ryan McGuire
Student Sheet 2a + 5b	Plastic debris: Bigstock
Student Sheet 2b + 4c	Floating bottles: Monica Volpin
Student Sheet 2c	Green Turtle: XL Catlin Seaview Survey
Student Sheet 2d	Littered beach: Andrei Ciobanu
Student Sheet 3a	Lamu coast: Luigi Guarino Dhows: Eric Hersman Lamu Town: Henrik Bennetsen Beach: Cessna206
Student Sheet 3b	Lamu coast: Eric Hersmann
Student Sheet 3c	Lamu: Cessna206
Student Sheet 3d	Flipiflopi Project: The Sands at Nomads/Flipiflopi project
Student Sheet 4a	Recycling bins: epSos.de
Student Sheet 4b	Garbage: RitaE Cartoon: Circular Flanders
Student Sheet 5a	Bales of plastic: Michael Maňas
Student Sheet 5b	Indonesian plastic recycling: Friends of the Earth UK Bottle return machine: Wolfmann
Student Sheet 5c	Plastic cups: Meinereserampe
Student Sheet 5d	Plastic in river: Horia Varlan
Student Sheet 6a	Plastic waste: Ryan Hagerty
Student Sheet 6b	All images: Nathan Siegel
Student Sheet 6c	The Ocean Cleanup: The Ocean Cleanup
Student Sheet 6d	Plastic straw: Anemone123
Student Sheet 6e	Ecover product: Ecover Milk bottle: Anaterate Milk bottle in fridge: Unisouth Plastic bottle: Louis Eldon
Student Sheet 6f	Beach clean: Bombona78
Student Sheet 6g	Recycling machine: Mattes Pen parts: Pavel Krok Bottle: Falken
Student Sheet 6h	Recycle bins: Imordaf Beechwood toothbrush: Georganics Toothbrush: Photomix Grapefruit soap: Just soaps Shower gel: Bijutoha Metal bottle: Chillys bottles Plastic bottle: Pumpaid Beeswax wraps: Beeswaxwraps.co.uk Clingfilm: Eithne Darcy
Student Sheet 8b + 9b	Seagull: Maxpicel
Student Sheet 8c + 9c	Full bin: Antranias
All other photos	Encounter Edu

Ocean Plastics Geography 11-14 is a full unit of work aligned to the Geography Key Stage 3 programme of study.

The lessons address the issue of marine plastic pollution, the harm caused by plastics to the environment and communities, how we deal with all the waste, ending with a debate on approaches to reducing ocean plastic pollution. Fieldwork templates for investigating plastics in the local area are included as well as a wealth of case studies exploring both the human and physical elements of plastic pollution.

Where Learning Meets The World

www.encounteredu.com

Encounter Edu and Common Seas have partnered to create the Ocean Plastics Academy. We believe that equipping young people with the knowledge, experience and courage to address plastic pollution is an important part of the solution. Ocean Plastics Academy supports educators by providing them with an authoritative and standards-linked set of resources aligned with the national curriculum to support students to build their knowledge on related topics year on year. **www.commonseas.com**