

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

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.

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.

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.

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.

5. The worst thing about plastic (5 mins)

As a plenary, return to the starter and decide what the worst thing about plastic is.

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

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 [and it's link to the climate crisis](#) with slides 5-8.
- Hand out copies of Student Sheet 2b for students to complete in pairs.
- Slide 9 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, focus 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 5-9

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

TEACHER GUIDANCE 2 (page 2 of 3)

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 10-12 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 13-15.



Depending on the age of your class, consider whether some of the photos are too graphic.

Slideshow 2: Slides 10-15

Student Sheet 2c: Plastics and turtles

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 **and ecosystems, including how this can impact the climate crisis.**

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.
- **Slide 18 gives an overview of the problems of plastic pollution from consumption by marine species, to the impact of microplastics on ecosystem services, including impacts on blue carbon.**
- Slides 19 and 20 describe the ubiquity of plastics in the environment.
- Slide 21 describes how species can become entangled in plastic debris including fishing nets. This is well documented.
- Slide 22 describes how large pieces of plastic can fill or block the stomachs or marine animals leading to reduced energy, starvation and death.
- Slide 23 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 24 introduces microplastics and the fact that they are small enough to be eaten by more species.

Slideshow 2: Slides 16-28

Student Sheet 2d: Plastic action vote

Subject Update:

Learn more: How does plastic harm the marine environment?

TEACHER GUIDANCE 2 (page 3 of 3)

WHAT IS PLASTIC AND WHY IS IT A PROBLEM IN THE OCEAN?

Step Guidance

Resources

- Slide 25 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 26 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 27 looks at nanoplastics, which are particles small enough to cross the cell membrane. This is a worrying development, **recent research has confirmed their presence in the open ocean**
- 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 29

Plastic starters



Starter statement

The best thing about plastic is...

Plenary statement

The worst thing about plastic is...

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



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.

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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 found nanoplastics in the ocean but 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 microfibrils 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
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