POLLUTING THE OCEAN

TEACHERS GUIDE: SEONDARY SCHOOL (Age 11 – 16)

Lesson Summary

Pollution is flooding into the ocean continuously. Plastic and toxic waste form a fatal hazard for marine wildlife. In this lesson we discuss the issue of pollution, how it ends up in the ocean and the impact on marine wildlife.

This lesson will take approx. 45 mins.

Subjects relevant to

English, Geography, History, Science and Social Science.

Learning objectives

From this lesson students will:

- Learn about the types of pollution entering the ocean.
- Discuss the consequences of pollution for marine wildlife.
- Understand the issue of pollution in the ocean and discuss ways to prevent it.

Preparation

- This lesson has been designed to provide a complete lesson, but can be stopped at any time and split over multiple lessons, should you wish to include your own discussion/questions or incorporate the lesson activities.
- Definitions of key terms have been provided at the end of the guide to assist with the learning process.
- Each lesson has case study options showing Sea Shepherd campaigns, including videos to provide students with a firsthand experience of ocean conservation in action.
- Depending on whether students are working in a classroom or remotely, you can choose to discuss questions in the class or use the online learning app.
- This digital lesson has an interactive option called student devices. If you choose this option ask the students to bring their mobile phones or tablets to the lesson.
- Should you choose the interactive option, it will run a quiz during the lesson. Recommendation: only use this interactive option in classes of up to 30 students.
- Students can sign up on their mobile device to the www.LessonUp.app. They will be asked for a PIN code (this will appear automatically on slide 3 and will also show at the bottom of the screen). Students who sign up under a false name may be removed by the teacher.
- Students who do not have a mobile device can join the quiz with another student.
- If student devices is turned ON, you can opt to turn the sound and the share screen ON or OFF. Further on you can choose if you want to 'show ranking after each quiz' question. Doing so will create a competitive element, but it can be distracting. Recommendation: turn the 'show ranking after each quiz' OFF.
- The abovementioned options will also show if you click on the PIN code at the bottom of the screen.

Lesson plan

Slide 1 Introduction

This lesson is provided by Sea Shepherd. Sea Shepherd is a marine conservation organisation with a mission to protect the ocean and marine wildlife. Sea Shepherd works globally on a range of issues impacting the ocean, running numerous direct action campaigns each year. Ocean pollution is one area Sea Shepherd is addressing in order to protect marine wildlife.

Slide 2 Lesson action icons

During the lesson we will use these icons to identify the learning actions.

Slide 3 Lesson summary

During this lesson we will look at why pollution is an issue and how the ocean gets polluted.

INTERACTIVE JOIN – ask students to go to www.LessonUp.app

Slide 4 Empty ocean by 2050

Scientists estimate that by 2050 the ocean ecosystem will be on the verge of collapse, empty of fish and marine wildlife, unless urgent action is taken on the issues impacting the ocean and marine wildlife.

Show this video (2.53min), which explains how important all species are to our planet.
https://www.youtube.com/watch?v=TLcA31VRlRU

Discuss the video with the class and what it means.

Slide 5 Ocean pollution

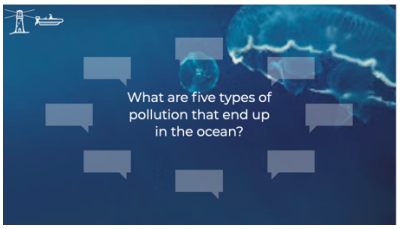
Ask students to answer the following question using www.LessonUp.app or discuss in the classroom.

"What do you know about pollution in the ocean?"

Slide 6 Types of pollution

Ask students to answer the following question using www.LessonUp.app or discuss in the classroom.

"What are 5 types of pollution that end up in the ocean?"



Slide 7 What is ocean pollution?

Ocean pollution comes in many different forms, from chemicals, oil spills, noise pollution, fishing gear, wood, metal, glass, paper to plastics.

Slide 8 Plastic pollution

There are actually thousands of types of plastics made today, all with a specific purpose in mind. Most are made from chemical substances that, when submerged in water, could leach chemicals into the environment.

Up to 90% of marine debris is believed to be plastic based.

There are different ways plastic ends up in the ocean. These are some you may not know end up in the ocean:

- A lot of clothing is partially made of plastic. When these clothes are washed, small pieces of plastic start to break off and are washed down the drain. These are referred to as microfibers.
- Nurdles are small plastic pellets that are used to manufacture plastic products. This way the plastic is easier to transport and integrate into manufacturing than sheets or blocks of plastic. When containers full of plastic pellets are lost at sea, these plastic pellets are often found washing up on beaches and coastlines.

- Micro beads are used in products like facial cleansers, scrubs, shower gels and toothpaste. It is likely that, when cleaning your teeth you are washing plastic beads down the drain. Some countries are now banning micro beads and demand natural alternatives to be used.
- Glitter also washes straight down the drain and into the ocean harming marine wildlife. There are non plastic alternatives that can be used instead.

Slide 9 Abandoned, Lost and Discarded fishing gear

Abandoned, Lost and Discarded fishing gear make up a significant portion of plastic in the ocean.

Researchers found that around 46% of plastic in the North Pacific is from commercial fishing gear. Globally over a fifth of the plastic in the ocean comes from commercial fishing gear.

What does ALD mean?

- Abandoned – means deliberate non retrieval of fishing gear, intentionally left behind.
- Discarded – deliberate disposal of fishing gear. Damaged or illegal gear thrown overboard before heading to port.
- Lost – means accidental lost at sea, for instance during a storm.

For more information on fishing gear, refer to the lesson: Abandoned, Lost and Discarded fishing gear.

Slide 10 How big is the issue?

640,000 tonnes of abandoned, lost and discarded fishing gear ends up in the ocean each year.

Each year over 12 million metric tonnes of trash finds its way into the ocean. This is the equivalent of at least one garbage truck full of plastic rubbish every 40 seconds being dumped into the ocean. (That is 788,400, garbage trucks of rubbish every year, at approx 15.2 tonnes per truck).

The amount of rubbish going into the ocean is still increasing. In the coming years this could soon be two garbage trucks a minute.

This poses a huge risk for marine wildlife that either ingests or becomes entangled in the rubbish.

Slide 11 Question

Ask students to answer the following question using www.LessonUp.app or discuss in the classroom.

"Why is pollution in the ocean an issue?"

Slide 12 Trashed ocean

One of the concerns with plastic pollution is that marine wildlife may mistake it for food and tries to eat it, or will eat it by accident.

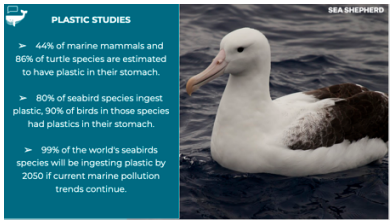
Marine wildlife naturally is not familiar with plastic. Can you image being a baleen whale feeding on krill and fish, but also scooping up plastic bags and other rubbish.

Show this video (1.33mins) and then discuss how it makes the students feel, realizing this is what marine wildlife are putting up with every day:
https://www.youtube.com/watch?v=k0_8vBijO1s&t=6s

Slide 13 Plastic studies

Scientific studies on plastic pollution are revealing frightening results:

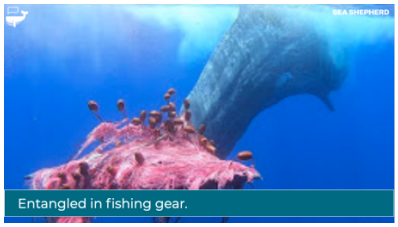
- 44% of marine mammals and 86% of turtle species are estimated to have plastic in their stomach.
- 80% of seabird species ingest plastic,
- 99% of the world's seabirds species will be ingesting plastic by 2050 if current marine pollution trends is not stopped.



Slide 14 Entangled in fishing gear

Entanglement in fishing gear:

- Marine wildlife gets entangled in nets and lines and can't escape.
- Migrating whales become entangled in cray pots and traps. Dragging along the fishing gear will tire out the whale.



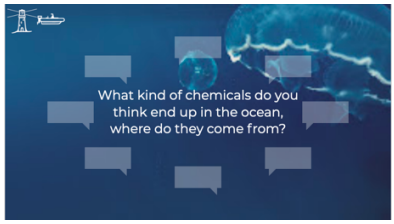
Slide 15 Chemical pollution

- Everything from household chemicals, agricultural chemicals and pesticides ends up in the ocean.
- Oil disasters and the chemicals used for clean ups.
- Industrial chemicals dumped or leaking into waterways or the ocean.

Ask students: "What impacts do you think chemicals in the ocean have on marine wildlife?"

- High levels of mercury, PCB's, DDT and other chemicals found in fish, especially apex predators – whales, dolphins, sharks and tuna.
- Long term impacts on health and birth defects in young animals.

Slide 16 Chemical pollution



Ask students answer via www.LessonUp.app or discuss in classroom:

"What kind of chemicals do they think end up in the ocean, where do they come from?"
Some examples:

- Household cleaning products.
- Medications.
- Cigarette butts.
- Pesticides, herbicides and weed killer used by the agriculture industry.
- Industrial chemicals from factories.
- Chemicals that leach from plastics.
- Sunscreen – chemicals in sunscreens are damaging coral reefs and kill fish.
- Petrol chemicals – oils and fuels from cars and boats.

Slide 17 How does pollution end up in the ocean?

Ask students answer via www.LessonUp.app or discuss in classroom:

"How do you think pollution ends up in the ocean? "

Slide 18 Washed away

Down the drain: Some plastics and chemicals are washed down household drains such as micro plastics like micro beads, glitter and micro fibers from clothes, and cleaning products.

Left on beaches: Visitors to beaches leave behind their rubbish, which is washed into the ocean with the tide, or blown into the ocean by the wind.

Dumped on streets, parks or school grounds: The wind or rain blow and move it into stormwater drains, creeks and rivers, eventually leading to the ocean.

Slide 19 Tourists

Tourists leaving rubbish behind.

Some tourist destinations are island nations who have limited facilities to manage waste. Visiting tourists leave behind their waste for locals to remove. Rubbish dumps are close to the water and can be washed into the ocean during storms.

Slide 20 Dumped

Intentionally dumped into the ocean by individuals or companies in order to save money. Instead of disposing of rubbish or chemicals properly it is dumped into waterways or directly into the ocean.

Dumped by factories
Not all countries are set up with proper waste or hazard management facilities. There are still areas where factories simply dump their waste, chemicals and rubbish into rivers.

Dumped into waterways by communities
Not all countries are set up with proper waste management facilities. When there are no waste removal procedures in place, communities will dump their rubbish into rivers for it be taken away.

Slide 21 Overboard

Dumped overboard from ships – cruise ships
While cruise ships are required to manage their waste and offload it in port, some are still dumping it overboard when in international waters, when no one is watching. Dumping at sea saves them money.

Lost overboard from cargo ships – during storms containers fall overboard.

During severe weather and rough seas, it is possible for shipping containers to come loose and topple overboard. These may sink, or break open and the contents gets into the ocean and may wash up on beaches.

Slide 22 Oil spills

Oil leaking from oilrigs or ships after an accident. These can leak into the ocean for days before clean ups can properly stop the oil from entering into the ocean.

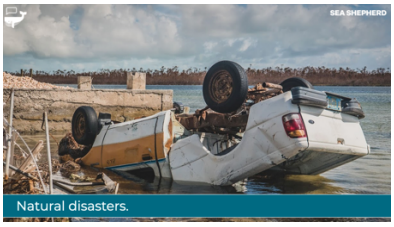
Ask students: "What do you think the impacts of oil spills would be on marine wildlife and the ecosystem?"

Slide 23 Natural disasters

Major floods, storms, cyclones, tornadoes and tsunamis washing household items into waterways and the ocean.

During heavy weather homes and businesses can be flooded or blown away, with items ending up in the ocean.

In 2011 a tsunami hit the north east coast of Japan, with homes and villages swept into the ocean. Many people lost everything to the ocean. Debris from this tsunami has slowly made its way across the Pacific ocean, years later washing up on distant shores.



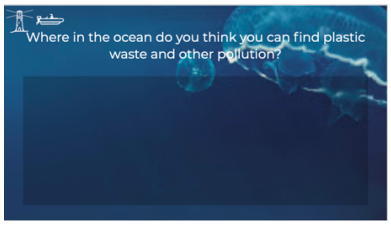
Slide 24 Where in the ocean?

Ask students answer via www.LessonUp.app or discuss in classroom:

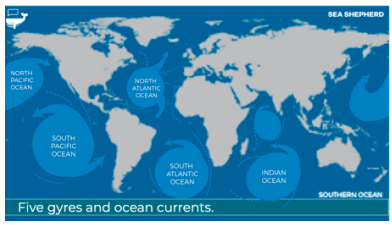
"Where in the ocean do you think you can find plastics and other pollution?"

Everywhere! Micro plastics and chemicals are being found in marine wildlife in most of the ocean, from the Artic to Antarctica. They are even finding plastic and other rubbish at the bottom of the Mariana Trench.

The Mariana Trench is located in the western pacific ocean and is the deepest place on earth at nearly 11,000 meters or around 36,000 feet (almost 7 miles) deep.



Slide 25 Five gyres and ocean currents



Once trash and pollution reaches the ocean it gets caught up in ocean currents and may be moved out into the gyres.

Gyres are areas where the ocean currents meet. There are five main gyres in the ocean.

The North Pacific gyre is one of the worst with thousands of square kilometers of rubbish. It's hard to estimate the size because much of the rubbish is floating just below the surface.

Slide 26 Question

Ask students to answer via www.LessonUp.app or discuss in classroom.

"What are some of the ways we can make a difference and protect marine wildlife from pollution?"

Slide 27 Changing what we do

We can make a difference, by reviewing what we do and use, we can help make a difference:

What we buy and consume:

- Refuse – Say no when offered a straw or plastic bag.
- Reduce - If you don't really need it or if something will harm the environment don't use it. Reducing our use of single use plastic products reduces the risk it will end up in the ocean.
- Reusable - Instead of single use plastic products that end up in the ocean it is better to choose reusable items.
- Restrict - While it may not be avoidable to buy some items in plastic, buying the bulk version and not multi-paks will help. For example juice boxes or chips.

What we do with items that are broken or damaged:

- First try to repair – why buy new when you can simply learn how to repair things.
- Second repurpose – if you can't repair an item then think of new ways you can use it. Old sheets and clothes for example can be used to make pouches for orphaned/injured wildlife.
- Thirdly refinish – would a new coat of paint or polish make it useable again.

What we do with items we no longer need:

- Rehome - if an item is in good condition but you don't need it anymore, like toys you have outgrown. Then they could be cleanup up and donated to a charity for someone who has very little, they can be sold/swapped at swap markets, or you can have your own swaps with family and friends.

- Recycle - can't repurpose or repair it, then recycle as much as you can. Make sure you separate out your rubbish between what can go into the compost bin, recycling bin and normal waste. The less you send to landfill the better, especially plastics.

  Some plastics can be returned to stores for recycling, like ink cartridges. Others may be donated to special programs where they can be converted for 3D printing. Such as programs to make items that help communities, like making artificial limbs.

  Only 9% of the plastic ever produced is estimated to have been recycled.

What we do with waste / marine debris found on land or in the ocean:

- Remove rubbish from parks, schoolyards and beaches. Every bit you pick up helps prevent rubbish from ending up in drains and waterways and ultimately in the ocean.

- Help recover marine debris from waterways and the ocean. Join in dives to remove rubbish from around jetties / piers, reef systems or the seafloor.

  Note – ensure you obey the laws, some areas have restrictions on removing rubbish, like fishing nets, to ensure the reef or ecosystem is not damaged.

Slide 28 Preventing ocean pollution

Other than changing what we buy and use, how can we, or our governments help stop the issue?

Discuss these ideas with students – what would they do, how could it work, what would be the barriers to it working:

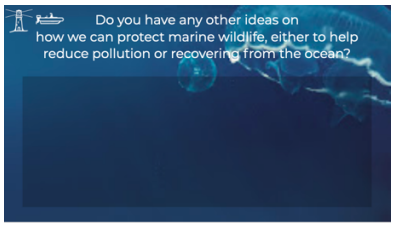
- Implement measures to stop fishing vessels dumping nets or create measures to ensure they track and retrieve lost nets.
- Implement stronger laws or monitoring to stop marine litter from ships.
- Look at ways to factor into the pricing of products the true cost of plastic disposal.
- Improving farming methods to reduce chemical run off.
- Encourage the use of ecofriendly products and plastic alternatives.
- Invest in waste management infrastructure for poorer countries.
- Ban single use plastics – like plastic bags.
- Conduct research to develop non toxic materials that are compostable.
- Develop new ways to improve recycling rates and the use of materials.

- Look at ways to stop people littering – education and awareness, or fines.
- Fund methods to remove waste from the ocean.

Slide 29 Question

Ask students to answer via www.LessonUp.app or discuss in classroom.

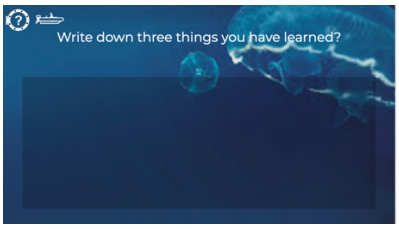
"Do you have any other ideas on how we can protect marine wildlife apart from reducing the use of plastics and recovering plastics from the ocean?"



Slide 30 What did you learn?

Ask students to answer the following question using www.LessonUp.app or discuss in the classroom.

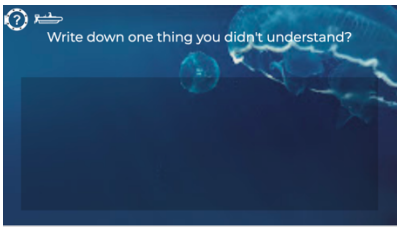
"Write down three things you have learned?"



Slide 31 What don't you understand?

Ask students to answer the following question using www.LessonUp.app or discuss in the classroom.

"Write down one thing you didn't understand?"



Slide 32 Case Studies

Sea Shepherd Case Studies cover a number of Sea Shepherd campaigns and show video of some of our work to stop ocean pollution. These can be used to enhance the learning experience from this lesson

Slide 33 Close

Case Study Options

Case Study – Plastic Pollution
Case Study – Ghostnet Campaign

Key Definitions

Fishing gear – includes nets, lines, traps, pots, FAD's and other devices used by the fishing industry to catch or trap marine species.

Ghostnets – abandoned, lost and discarded nets that float in the ocean, which are still trapping marine wildlife.

Gillnets - walls of netting set in a straight line that are very effective at trapping fish. Using floats on the surface the length of the lines can be adjusted to set the nets at varying depths. They are usually set several kilometres below the surface and can be many kilometres long. They are used for deep living fish like toothfish.

Gyre – an ocean gyre is any large system of circulating ocean currents, particularly those pushed by large wind movements.

Long lines - fishing lines that can run for up to 100 km with thousands of baited barbed hooks.

Lost fishing gear – accidental loss at sea of fishing gear.

Microbeads – manufactured plastic particles of less than one millimetre.

Microplastics – small pieces of plastic, created from fragmented plastic, less than 5mm in length.

Nurdles – pre-production plastic pellets that are melted and used in manufacturing products.

Ocean currents – movement of ocean waters by a number of factors, such as wind, ocean temperature and waves.

YOUR FEEDBACK

We value your feedback and would be pleased to hear your thoughts about this lesson and activities. Any comments, suggestions or requests for further information can be sent to education@seashepherdglobal.org.