



Marine Litter

Lost at Sea



Credit Tracey Williams



Municipalities for Sustainable Seas

Recommended

All activities

Duration

Number of participants



Ages 5-7

Ages 7-11

90 minutes

Max 33 pupils

Overview:

Plastic Lost at Sea explores what happens to marine litter in the ocean through three interactive activities; two simple floating and sinking experiments, and an interactive exercise, '[Plastic Adrift](#)', which simulates a real-life event in 1992 where 29,000 rubber ducks were lost at sea.

Learning Objectives:

By investigating the floating and sinking of different materials in water.

I can demonstrate that some types of plastic float while others sink, and use observations to predict the fate of plastic marine litter in the ocean.

I am familiar with how ocean currents move, and how marine litter is transported worldwide with this system.

Curriculum Links:

Forces, Material Science, Topical Science, Human Impact,

Preparation and resources:

Resources Provided:

[Glossary](#)

[Table of Plastic Polymer Types, Float/Sink](#)

[Float or Sink Worksheet](#)

[YouTube 'The Epic Journey of the Plastic Ducks'](#)

[Lost at Sea](#) - Lost Ducks and More stories of plastic cargo lost at sea.

[Plastic Adrift](#) computer simulation

[Plastic Duck Location Maps](#)

[TedTalk_ How do Ocean Currents Work?](#)

Resources Needed:

Activity One	Activity Two
One basin/bowl per group Part one: Suggested items for the experiment: Rock, golf ball, metal nut, tennis ball, pin pong ball, paper clips, straws, sponge. Include an empty drink bottle with the lid. Part two: 5/6 different types of plastic, take examples from the Plastic-type (polymer) and float/sink table. Examples could include a piece of plastic bag/bin liner, plastic film, a small plastic toy, a piece of yogurt pot, a straw, and plastic cutlery.	Colouring pencils. Map of the world for reference.

Floating and Sinking Experiment

Setting the scene:

Have you ever played with toys in a bath, swimming pool, or ocean? Have you noticed bath toys float, while other objects like rocks sink? What makes something float or sink? Usually, something that's light floats, and something that's heavy sinks!

How can a heavy boat float? It has to do with the density of an object. Density is the amount of stuff (or matter) in an object of a certain size (or volume). For example, a tennis ball will float, while a golf ball sinks. The tennis ball is full of air, it has less stuff packed into it. The golf ball is full of stuff packed tightly together which makes it more dense than the tennis ball. In water, things that float are less dense than water, while things that sink are more dense.

This is also true for plastic litter. Different types of plastic or [plastic polymers](#) have different densities so not all plastics float on the ocean. Plastics that are less dense than water, such as plastic bags, bottle caps, and fishing ropes, float on the ocean surface. More dense plastics, such as plastic film wrapping, and cigarette butts sink to the ocean floor. Floating plastic litter can travel on [ocean currents](#), and wash up on beaches all around the world.



Activity One:

30 minutes

Class activity or groups 3/4

Part one:

Take different [objects](#), including an empty drink bottle with a lid. Add them to a basin of water. First, ask the pupils to predict if the item will float or sink and fill out the [worksheet](#) provided. Ask pupils to fill in their observations.

Discussion and Observations:

Have a class discussion on the results. Did the pupils successfully guess the density of the items relative to water?

Part two:

Next, take different [types of plastic](#) (polymers) with different densities. Use the [table](#) provided as a guide. Add the bottle lid and a cut piece of the drink bottle separately. Add items to a basin of water.

First, ask the pupils to predict if the item will float or sink and fill out the Float or Sink [worksheet](#) provided.

Ask pupils to fill in their observations.

Optional:

Ask pupils if they can identify the type of plastic using the [Plastic-type \(polymer\) and float/sink table](#). PP (Polypropylene) and HDPE (High-Density Polyethylene) will float on water, HDPE will sink in vegetable oil and PP will float.



Discussion and Observations:

Have a class discussion on the results. Did the pupils successfully guess the density of the items relative to water? What happened when they added the lid and piece of plastic drink bottle separately?

Note:

An empty plastic bottle will float because it is full of air and therefore less dense than water. The bottle and lid are made from two different types of plastic. The lid is made from HDPE which is less dense than water. The lid will float. The plastic bottle is made from PET which is denser than water. When the bottle is cut up the cut into pieces it will sink. When a bottle is lost at sea, it will degrade and break into pieces or fragments called [microplastics](#). The lid will float and might wash up on a beach, while the fragmented bottle will sink to the sea floor.



Reflect:

Ask the pupils to relate this to marine litter by guessing which types of litter will end up floating in the ocean and which will sink to the bottom, if disposed of improperly. What happens to plastic that floats in the ocean? Where will it end up?

Friendly Floatees: Rubber Ducks Lost at Sea

Setting the Scene:

[Shipping containers](#) ([Slide 2](#)) are large metal boxes that are used to transport goods by sea. Every year around 500 to 1000 are lost at sea. Sometimes due to big storms at sea, human mistakes, or something breaking on the ship, containers may get loose and fall overboard. This can cause problems at sea for marine life, as well as safety hazards for other ships. Some containers may eventually break down and release their contents into the water, which creates marine litter in the ocean which washes up on beaches.

In 1992, a [cargo ship](#) transporting bath toys from China to the U.S.A. got caught in a big storm. A shipping container fell overboard releasing 29,000 plastic ducks into the ocean. Over the years the plastic ducks floated in the ocean and washed up on beaches worldwide, some even froze into icebergs. Scientists used the duck's journeys to map how ocean water moves around the world. They found that all our oceans and seas are connected by a system of [ocean currents](#).



[Activity Two](#)

30 minutes

Class activity or groups 2/3

Watch the story of the  [The epic journey of the plastic ducks](#) .

Open up [Plastic Adrift](#). Click on the map and show the class the computer simulation of the ducks dispersing in the ocean. Allow the simulation to run for the full 10-year time period.

With the class, observe the locations in which the plastic ducks end up. Look at the [map of duck landings](#) ([Slide 3](#)) and the [map of ocean currents](#) ([Slide 4](#)) provided.

Note: The Plastic Adrift map can be moved from left to right with the cursor to access the Pacific Ocean. Always refresh the page before each simulation.

- Get the pupils to work in pairs and give each pair a [Plastic Duck Location map](#) worksheet and a [map of ocean currents](#).
- Get each group to pick a location where a shipping container is lost in the oceans, and draw lines to indicate how the ducks move through the ocean and what countries they may end up in.

Location ideas! Try all five oceans. Arctic, North Atlantic, South Atlantic, North Pacific, South Pacific, Indian, and Southern Ocean.

- Next, open [Plastic Adrift](#) and let each group simulate their location. Allow the simulation to run for the full 10-year time period. With the class, observe the locations in which the plastic ducks end up, and compare this to their worksheets and the [map of ocean currents](#) ([Slide four](#)).

Optional: See [Further Learning](#) for more Famous Cargo Spills.

Discussion and Observations:

30 minutes

Have a class discussion about each group's results. How do their maps, the map of ocean currents, and the Plastic Adrift model compare?

Optional Discussion Topics: Ocean Gyres

Many ducks remain bobbing in the middle of the ocean in regions called [Gyres](#) (Slide five). Gyres are large rotating ocean currents, like a giant whirlpool in the ocean. There are five major gyres: the North and South Pacific Subtropical Gyres, the North and South Atlantic Subtropical Gyres, and the Indian Ocean Subtropical Gyres. Locate these on the [map of ocean currents](#).

Ocean gyres typically flow clockwise in the Northern Hemisphere and counterclockwise in the Southern Hemisphere. Use [Plastic Adrift](#) and click a location in the North Atlantic and the South Atlantic and a location in the North Pacific and the South Pacific, to observe this phenomenon.

This is called the [Coriolis Effect](#). Watch this Ted Talk for more about ocean currents, gyres, and the Coriolis Effect.



Watch How do ocean currents work? - Jennifer Verduin

The Great Ocean Garbage Patches

Plastic marine litter gets pulled into these gyres and can circulate in the ocean for many years. These are called ocean garbage patches. The most famous being the Great Pacific Garbage Patch. The Great Pacific Garbage Patch is located in the North Pacific Gyre. The patch is an area of concentrated (mostly plastic) marine litter.

Can you find the Great Pacific Garbage Patch on the [map of ocean currents](#)? Use [Plastic Adrift](#) and click on locations in the North Pacific Ocean to observe this phenomenon.

Reflect:

Ask the pupils to relate this to marine litter. What happens to plastic that floats in the ocean? Where will it end up?



Further Learning:

If the class is fascinated by this story, here are many more Famous Cargo Spills stories (see [Lost at Sea PowerPoint Slides](#)):

- In 2019, 10,000 Nike shoes were lost from a cargo ship traveling the Oregon Inlet, USA.
[Why are Nike trainers washing up on beaches? - BBC News](#)
- In 1997, nearly five million pieces of Lego were lost from a cargo ship heading from the Netherlands to the USA that was hit by a freak storm wave off Cornwall.
[Lego Lost at Sea exhibition at Royal Cornwall Museum - BBC News](#)
- In January 2014, plastic Hewlett-Packard (HP) inkjet cartridges were lost from a container ship in the middle of the North Atlantic Ocean.
[HP cartridges wash up around the UK and Europe after the spill - BBC News](#)

Open [Plastic Adrift](#) and simulate these cargo spills, and [maps and images](#) of all three events to back up your findings.

Glossary:

Coriolis Effect

The rotation of the Earth on its axis deflects the atmosphere toward the right in the Northern Hemisphere and the left in the Southern Hemisphere, resulting in curved paths. The deflection of the atmosphere sets up the complex global wind patterns that drive surface ocean currents.

Cargo Ship

A cargo ship or freighter is any kind of ship that carries cargo, goods, and materials from one port to another. Thousands of cargo carriers travel on the world's seas and oceans each year and handle most international trade.

Ocean Currents

The water in the oceans is constantly moving in patterns called currents. As the currents flow around the planet, they move cold and warm water from one place to another. This changes climate and temperatures all over the world.

Microplastics

Microplastics are tiny plastic particles and fibres smaller than 5 millimetres. Microplastics are formed in the oceans when sunlight, chemical reactions, waves, and water currents break down or fragment large plastic items, called **macroplastics**. Some microplastics are made intentionally, such as preproduction pellets, which are tiny beads of plastic that are used to manufacture larger plastic items, and microbeads for toothpaste, scrubs, and skincare products.

Monomer

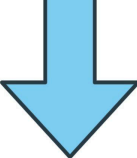
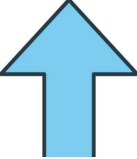
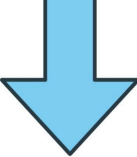
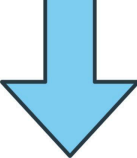
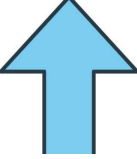
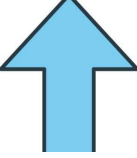
Monomers are the smaller units from which larger molecules such as **plastic polymers** are made.

Plastic Polymers

Plastics always consist of large molecules called polymers. Polymers, in turn, consist of many identical small particles that are strung together like a chain. We call these individual small particles monomers. The length of these polymer chains determines the properties of plastic. For example, the length of the polymer chain for polyethylene (PE) determines the hardness of this type of plastic.

Plastic-type (polymer) and density table

<https://www.bpf.co.uk/plastipedia/polymers/polymer-thermoplastics.aspx>

Polymer code	Name	Example	Density g/ml	Float / sink*
	Polyethylene terephthalate	Drink bottles, food packaging, salad trays.	1.38-1.39	
	High-density polyethylene	Drink bottle caps, milk bottles, shampoo bottles, detergents and washing-up liquid bottles.	0.95-0.96	
	Polyvinyl chloride	Cling film, film for wrapping meat and vegetables, bubble wrap, bank cards, shower curtains	1.16-1.45	
	Low-density polyethylene	Toys, plastic bags, bin liners, plastic wrap, and film for food.	0.92-0.94	
	Polypropylene	Toys, storage boxes, car parts, yogurt pots, straws, shampoo, and detergent bottles.	0.90-0.91	
	Polystyrene	Disposable coffee cups, plastic food boxes, plastic cutlery, and packing material.	0.02	
	Water Sea water Vegetable oil		1.00 1.03 0.91-0.93*	

Polymers with a density greater than the density of water (1g/ml) will sink.

*Arrows depict whether plastic floats or sinks in water.

*HDPE has a density greater than vegetable oil and will sink.

Float  or Sink 

[illegible]

Plastic Duck Location Maps



Ocean Currents Maps

