Seashore science

Primary Science Teaching Trust

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Foreword

When I mention that I grew up in North Devon, people often assume that this meant regular seaside weekends with a bucket and spade. In fact, we lived in farming country – less than ten miles from the coast, but it felt like a different world. Perhaps once a year we would pack our sandwich boxes and swimming costumes into the car, then spend a few happy hours lying on the sand, paddling in the water or looking in rock pools.

For many children, a trip to the seaside is something to be cherished. This fabulous new resource shows how it can also be stimulating learning experience. Seashores are ideal places for children to observe and interact with the natural world, and to deepen their understanding of the science behind these precious, diverse environments. Once your trip is organised, the activities in Seashore Science can all be done in situ, with little preparation but many opportunities for rich learning. I hope you find them a valuable addition to your science toolkit.

Martin Pollard,
CEO, Primary Science Teaching Trust

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Lew Trenchard C of E Primary School
Mevagissey Primary School
St Hilary School
Brunel Primary School
St Nicolas C of E Primary School
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Introduction

Taking learning outside the classroom offers numerous benefits for children's physical health and mental well-being. A sensory-rich outdoor environment can stimulate cognitive development and foster creativity, as well as encourage curiosity and develop problem-solving skills. Spending time in nature supports children to feel more connected to, and want to look after, the natural world.

Learning on the seashore offers specific opportunities to encourage awareness of environmental issues such as plastic pollution and global warming. Exploring the impact that these have on marine and seashore ecosystems will help to cultivate a greater environmental awareness and a sense of stewardship, giving children a lifelong appreciation for the world around us.

Seashore Science has been created as a 'pick up and go' set of 15 lessons to carry out at the beach, all with minimal requirements for equipment and preparation. The lessons cover substantive concepts relating to the biological, chemical and physical sciences, and they all offer opportunities to develop disciplinary knowledge and to learn and apply skills of working scientifically. The lessons are highly adaptable so they can be used with any primary age, and in a variety of coastal locations and types of shoreline.

A note about teaching and learning about rocks

Visiting the beach can enrich teaching and learning about rocks. While Seashore Science provides opportunities for observing, handling and discussing rocks, it does not include the grouping and classifying of rocks. The Primary Science Teaching Trust has another free resource that covers this extensively. The Big Jurassic Classroom includes exciting activities for learning about rocks, fossils and evolution and shows teachers how they can use their local environments to explore rocks and inspire interest in the UK's geological history.

Download The Big Jurassic Classroom **here**.

The Seashore

The seashore is the transition between sea and land. It is repeatedly exposed and submerged by the ocean and many of the living things on the seashore are adapted to survive both on land and in the sea. When you are planning your visit to the beach, it can be helpful to think of the seashore in different zones:

- The upper shore is the area at the limit of high tide. It is only submerged for a few hours each day and is dominated by small periwinkles, barnacles, limpets and encrusting lichens. Some species of algae such as channelled wrack can be found here, but all must be adapted to survive drying out and extreme changes in temperature.
- The middle shore is the main tidal belt covered and uncovered at every tide cycle, dominated by brown seaweed called wracks, barnacles, limpets, mussels, crabs, anemones and some types of green and red algae. Inhabitants must be equally able to survive exposed to air or underwater.
- The lower shore is the lower limit of the tide only exposed for a short period of time during spring tides (the lowest tides that occur every fortnight) and is dominated by a variety of organisms including kelps and red seaweed. There is generally a greater diversity of animals and seaweed here due to more stable conditions.

The strandline, also called the tideline, is the line or mark left on a beach by the highest point of the tide. It is often seen as a distinct area or band where items have been carried up the beach and deposited by the tide at high water. This debris is then left behind when the tide goes out again. Exploring the strandline provides evidence of pollution and gives rich opportunities to consider the impact of human behaviour on the seashore.

Health and Safety

PSTT recommends that a full risk assessment is carried out before undertaking a visit to the beach and before carrying out any of the lessons suggested in this resource. Children should be made aware of the Seashore Code (see page 68).

Particular safety issues to note include:

Tides – always check the tide times and aim to visit on a falling tide near low water.

Some stinging animals may be washed up onto the beach, including Portuguese Man o' War and other jellyfish. These can sting when 'dead' or stranded and should not be touched. They can survive short strandings too, so they are best left alone.

Handling debris and materials washed up on the strandline – it is recommended that children wear protective gloves.

Care of the natural environment

Many living things on the seashore are adapted to live in a very specific part of the seashore (for example under a rock or buried) and so they should always be returned to where they were found after any observation activity.

Animals that live in shells and attach themselves to rocks should not be pulled off the rock as they may not survive.

Seashore science

How to use Seashore Science

Each lesson has the following sections:

LEARNING OUTCOMES

A clear indication of the scientific concept areas covered by the lesson, and the ideas that the children might be expected to develop.

KEY VOCABULARY

A list of words specific to the lesson and the concepts encountered.

WORKING SCIENTIFICALLY

A guide to the opportunities for different types of investigation that might be carried out, as well as the different skills that the children might use and apply during the lesson.

CHECKLIST: BEFORE YOU GO TO THE BEACH

A health and safety reminder.

Suggestions for what it would be helpful for the children to have discussed before they go to the beach.

A list of essential and optional items that you need to take to the beach.

AT THE BEACH

A step-by-step list of suggestions about what to do at the beach.

KEY QUESTIONS

Prompts for the teacher to help children develop their thinking.

BACK IN THE CLASSROOM

Ideas for following up and extending the learning at the beach.

Suggestions for further resources related to the lesson (which could also be used before the visit to the beach).

BACKGROUND SCIENCE FOR TEACHERS

Explanations of the science behind the main theme of the lesson to support teachers to deliver the lessons from a position of strength. NB: this section is not outlining the intended knowledge that the children will learn; it is explicitly for teachers or, if appropriate, other adults who are accompanying the children to the beach.

1. It's a Jungle Out There!

'It's a Jungle Out There!' gives children the opportunity to explore the beach, the shoreline and rock pools to observe and identify different types of seaweed. They will look particularly at similarities and differences in the seaweed, and at the features of the locations where they are growing.

Learning outcomes

CONCEPTUAL UNDERSTANDING IN SCIENCE

The children will develop ideas about:

- ☑ The different types of seaweed that are growing on the seashore;
- ☑ Features of the different locations where seaweed is found;
- ☑ The impact of humans on the habitat of seaweed;
- ☑ How to look at a habitat without harming the living things that live in it.

KEY VOCABULARY

habitat
rock pool
seaweed
survive
environment
holdfast
blade or fronds
adaptation
float
flexible
current
tide

WORKING SCIENTIFICALLY

Investigation types – this activity provides opportunities for:

- Pattern seeking
- Identifying, grouping and classifying

Key skills the children might learn and apply:

- Asking questions
- Observing
- Recording data

Checklist: before you go to the beach

HEALTH AND SAFETY

- ☑ Carry out a full risk assessment.
- ☑ Check the tide times – going on a falling tide near low water is best, both for safety and to increase the likelihood of children finding a variety of seaweed.
- ☑ Make sure that children are aware of The Seashore Code.

PRIOR DISCUSSION WITH THE CHILDREN

To get the most out of the activities at the beach, it is helpful if the children have had the opportunity to discuss their ideas about:

- What seaweed is: it is a marine plant – like terrestrial plants it makes their own food but unlike them, its structure is not specialised into roots, stem and leaves;
- What is meant by a habitat, and features of habitats that make them favourable or unfavourable for particular living things to survive;
- Features of a seashore habitat, including changes in tide height, salty water, exposure to wind, changes in temperature (with day and night, seasons, and the tide), anchorage for roots;
- How scientists group and classify living things and how to use a branching key to identify a particular living thing.

WHAT YOU NEED IN YOUR RESOURCE BUCKET

Essential:

- White trays or tubs
- Hand lenses
- Paper and pencils

Optional:

- ID sheets/books
- Camera

At the beach

WHAT TO DO

- Give the children boundaries for an area in which to look and encourage them to find out how many different types of seaweed there are growing along the seashore, including in the rock pools. Tell the children that they can pick up and make a collection of pieces of seaweed that are loose, but that they should avoid pulling any seaweed away from places where it might be anchored, even if loosely so.
- Suggest to the children that they use hand lenses to look closely at one type of seaweed and then compare this with a different type, taking note of similarities and differences between them.
- Focus the children on observable features of the seaweed, e.g. its colour, its shape, the size, position and shape of any bladders, if it appears to be attached to a surface such as a rock or the sand, if they can find any evidence of animals living on the seaweed.
- Ask the children to make careful observational drawings of one or more different types of seaweed and where appropriate to label or annotate their drawings to indicate and describe any features that they have observed.
- Ask the children to work in groups to sort their seaweed samples into groups according to their own criteria, e.g. colour or shape.
- Give the children ID sheets and/or branching keys and ask them to try to identify the types of seaweed that they have found, or encourage the children to create their own branching key.
- Encourage the children to observe the locations where they find seaweed and notice if the same types of seaweed tend to be found in the same types of location – this could be done by creating a rough map of the area being surveyed and plotting where different types of seaweed are found.
- Prompt the children to look more closely at the locations where they found different types of seaweed and see if they can identify similarities and differences between the locations. Encourage them to relate these observations of the habitats to the specific features of the seaweed that they found in them.
- Ask the children to think about animals that might rely on seaweed for survival, e.g. by eating it, or using it as a shelter from the weather or from predators.
- It might be helpful to take photographs of seaweed found in different locations on the seashore to use as prompts back in the classroom.

KEY QUESTIONS

- What types of seaweed have you found on the seashore? What is the same about them and what is different? Why do you think there are differences?
- Where did you find most of the seaweed? Why do you think this is?
- How do you think seaweed is adapted to living on the seashore?
- How do we know that seaweed is a living thing?
- Why do you think some types of seaweed have air bladders in their fronds?
- How is seaweed essential for other living things?
- How might human activity affect the habitats of seaweed?
- What happens to all the living things in a rock pool when the tide comes in and goes out?

Exploring the variety of seaweed on the beach

Back in the classroom

EXTENDING LEARNING

- Use the photographs taken of different types of seaweed to create an identification guide or branching key.
- Try out the keys created on others in the class – can they identify the different types of seaweed?
- Compare and contrast one type of seaweed with one type of land plant. This could be done using pictures of each side by side, with ideas recorded around the edge.
- Use their learning about seaweed and seashore habitats to create food chains.
- Research products that use seaweed. They are eaten as part of different diets and can also be found as an ingredient in many other foods (e.g. ice-cream, jelly, processed meats), toothpaste and cosmetic creams, shampoo, garden fertilisers. The words 'alginate' and 'carrageenan' indicate that the product contains derivatives from seaweed. Children who have had an impression of their teeth taken at the dentist might be surprised to know that the material used is made of seaweed!
- Consider the impact of pollution on the survival of seaweed.

FURTHER RESOURCES RELATED TO 'IT'S A JUNGLE OUT THERE!'

Primary science teaching trust resources

- I bet you didn't know
  - Tree Restoration: It's now or never

Explorify activities

- Ponder On
- Remarkable Reef
- Green Producers

Background science for teachers

Seaweed is a type of marine algae that grows in the ocean. Sometimes it is referred to as a marine plant, but technically it is an algae. There are three main types of seaweed: green, red and brown. Each type has a particular structure as well as colour. Green seaweed is usually thin and ribbon like, while brown is usually much thicker and more robust, and red is often delicate with a red or purple hue. The green colour in green seaweed is caused by a pigment called chlorophyll which absorbs sunlight for photosynthesis (the process by which plants make food from carbon dioxide and water, using energy from sunlight). Brown and red seaweed also photosynthesise but they have different types of chlorophyll (hence their different colours) that is adapted to be effective at different levels of light intensity.

Seaweed is important for a variety of reasons. One of the most important is that it provides a vital source of food and nutrients for many marine animals, including fish. It also helps regulate the ocean ecosystem by absorbing carbon dioxide and releasing oxygen during photosynthesis.

Humans use seaweed in a variety of ways, e.g. it is commonly used in some cuisines, particularly in sushi and other Asian dishes, and in some ice creams, sweets and jellies. It is a rich source of minerals and nutrients and so is also often found in nutritional supplements and health products, including toothpaste. Seaweed is also being studied for its potential as a renewable energy source. Researchers are exploring ways to extract biofuels from seaweed, which could provide a more sustainable alternative to fossil fuels.

The structure of seaweed is important to its function and how it grows and survives. The parts of seaweed have different names from the parts of land plants. They are:

Holdfast: this is a root-like structure at the base of the seaweed which anchors it to a solid surface such as a rock or the ocean floor. It helps it to stabilise against the movement of the water and to remain in the same location when the tide goes in and out.

Stipe: this is a stem-like structure that supports the blades or fronds of the seaweed. Like a land plant's stem, it helps to transport water and nutrients throughout the seaweed.

Blades/fronds: these are the leaf-like structures that are responsible for photosynthesis. They vary hugely in size and shape, depending on the type of seaweed.

Air bladders: some seaweed has air bladders (technically called pneumatocysts) which are small gas-filled structures that help to keep the blades or fronds afloat in the water. This keeps them nearer the surface enabling them to absorb more sunlight to photosynthesise more effectively.

2. Seashore Safari

'Seashore Safari' encourages children to look closely at rock pools, the shoreline and other areas on a beach to find as many different types of plants (marine and terrestrial) and animals as they can. By looking carefully at features of these living things and where they found them, they can discuss how plants and animals depend on each other for survival. This activity could also be used with the tide pools that occur on sand or mud beaches.

Learning outcomes

CONCEPTUAL UNDERSTANDING IN SCIENCE

The children will develop ideas about:

- ☑ The animals and plants that live in rock pools and along the seashore, how they survive, and how they depend on each other;
- ☑ Simple food chains at the seashore;
- ☑ How human behaviour impacts these habitats;
- ☑ How to look at a habitat without harming the living things that live in it.

KEY VOCABULARY

rock pool
seaweed
animal and plant (including specific names of some of each)
tide
shell
habitat
food
survive
environment
adaptation

WORKING SCIENTIFICALLY

Investigation types – this activity provides opportunities for:

- Pattern seeking
- Identifying, grouping and classifying

Key skills the children might learn and apply:

- Asking questions
- Observing
- Recording data

Checklist: before you go to the beach

HEALTH AND SAFETY

- ☑ Carry out a full risk assessment.
- ☑ Check the tide times – going on a falling tide near low water is best, both for safety and to ensure that rock pools are exposed and can be explored.
- ☑ Make sure that children are aware of The Seashore Code.

PRIOR DISCUSSION WITH THE CHILDREN

To get the most out of the activities at the beach, it is helpful if the children have had the opportunity to discuss their ideas about:

- What they think they might find at the beach and prior experience of looking in rock pools or along the shoreline;
- What is meant by a habitat, and features of habitats that make them favourable or unfavourable for particular living things to survive;
- Features of a seashore habitat, including changes in tide height, salty water, exposure to wind, changes in temperature (with day and night, seasons and the tide), anchorage for roots;
- How different living things at the seashore obtain their food and shelter;
- How scientists group and classify living things and how to use a branching key to identify a particular living thing.

WHAT YOU NEED IN YOUR RESOURCE BUCKET

Essential:

- White trays or tubs
- Small measuring spoons, scoops or short-handled nets
- Hand lenses
- Paper and pencils

Optional:

- ID sheets/books
- Camera

At the beach

WHAT TO DO

- Prompt the children to find a rock pool (or part of the beach or shoreline) to investigate and encourage them to observe it carefully without disturbing it for around ten minutes. They should try and identify as many different plants and animals as possible.
- Tell the children to fill up their tray with some water from the rock pool. They can then carefully scoop up animals and plants that they find and put them into their tray to observe more closely using a hand lens. They should only keep living things out of the rock pool for a short time, and then carefully return them to where they found them. They can also carefully lift up stones in the rock pool to observe what is underneath, or to see if anything that is hiding will swim out.
- Ask the children to make careful observational drawings of one or more of the living things in their trays and where appropriate to label or annotate their drawings to indicate and describe any features that they have observed.
- Ask the children to see if they can find any shells in their rock pool and, if so, to observe them closely and suggest, with reasons, what sort of animal might have lived in the shell.
- If you are using ID sheets and/or branching keys, give these to the children and ask them to try to identify the living things that they have found, or encourage them to create their own branching key.
- Prompt the children to think about how the different living things that they have found survive, e.g. how they obtain food and shelter, or how they protect themselves. Encourage the children to think about what a seashore food chain might look like.
- Ask the children to discuss what will happen to everything in their rock pool when the tide comes in, and then what they might find in the rock pool the next time the tide goes out again.
- Encourage the children to explore a second rock pool to identify similarities and differences between it and the original one they explored. They can also look around other areas of the beach to see what living things they find there and how this differs from the rock pool.
- It might be helpful to take photographs of different living things that they have found on the seashore to use as prompts back in the classroom.

KEY QUESTIONS

- What different living things can you see in the rock pool? How many kinds of (marine) plants? How many kinds of animal?
- How are you deciding if something is alive?
- Did you find anything under any of the stones? Why might they have been under the stone?
- How do the different living things in the rock pool obtain their food and shelter and how do they protect themselves?
- If you found any shells, what sort of creatures do you think used to live in them? Where are they now? Where did their shells come from?
- What happens to all the living things in a rock pool when the tide comes in? What about when the tide goes out? What difference would it make on a sunny and/or windy day? If you came back tomorrow, what do you think you would find in the same rock pool?
- How might human activity affect the living things in a rock pool?

Exploring living things on the seashore

Back in the classroom

EXTENDING LEARNING

- Use the photographs taken of different living things to create an identification guide or branching key.
- Try out keys created on others in the class – can they identify the different living things? Can they suggest improvements to each other's branching keys?
- Reproduce their learning by making a model rock pool. An old washing up bowl or similar is a good starting point, and the children can collect stones to represent rocks, and make representations of animals and marine plants that they found from plasticene or other suitable materials.
- Use their learning, with further research, to create rock pool food chains.
- Find out more about how living things in rock pools survive when the tide comes in and effectively floods the rock pool, or how they survive when the tide goes out and it is a sunny and/or windy day (which would cause water to evaporate from the surface, with this in turn causing the concentration of salt in the water to increase, and eventually for salt to start crystallising on the rocks at the surface of the rock pool).
- Consider the impact of pollution on the survival of living things in rock pools.

FURTHER RESOURCES RELATED TO 'SEASHORE SAFARI'

Primary science teaching trust resources

- **A Scientist Just Like Me** - find out more about Dawood, a marine biologist, and Kelsey, a deep sea ecologist
- **Science for One** - Cup Chains (in 'Cup' activity sheet)
- **I bet you didn't know** - How to calculate the age of a shark; Biodiversity and trophic cascades

Explorify activities

- **Have you ever ....watched a small animal in its habitat?**
- **Puddle pals**
- **Wet wet wet**
- **What impact do our choices have on habitats?**

Background science for teachers

The scientific study of life in a rock pool or on a beach is called marine biology. The seashore is a particularly interesting environment as it has parts that are exposed to air at low tide and then submerged by the sea at high tide, which creates an area known as an intertidal zone. Most seashores have approximately two high tides and two low tides over a twenty-four hour period, but the precise rhythm and timing of the tides is different in different places. Living things in intertidal zones have to be adapted to survive in both aquatic and terrestrial environments. For example, some aquatic animals have developed the ability to breathe air or to retain moisture in order to survive at low tide. The living things found in the intertidal zone will vary according to exactly where they are within the zone.

The upper shore is the area at the limit of high tide. It is only submerged for a few hours each day and is usually dominated by small periwinkles, barnacles, limpets and encrusting lichens. Some species of algae such as channelled wrack can be found here, but all must be adapted to survive drying out and extreme changes in temperature.

The middle shore is the main tidal belt covered and uncovered at every tide cycle, usually dominated by brown seaweed called wracks, barnacles, limpets, mussels, crabs, anemones and some types of green and red algae. Inhabitants must be equally able to survive exposed to air or underwater.

The lower shore is the lower limit of the tide only exposed for a short period of time during spring tides (the very lowest tides that occur approximately every two weeks), usually dominated by a variety of organisms including kelps and red seaweed. There is generally a greater diversity of animals and seaweed here due to the more stable conditions.

Rock pools are small pools of water that form on rocky shores during low or lower tides. They provide a habitat for many different species of plants and animals. Some of these are anchored to the rocks in the pool, and some are not, so may be carried away when the tide comes in. Living things in rock pools are adapted to survive the harsh conditions created by exposure to the sun, predators and waves. Sandy beaches also support a diverse range of life, including clams, sand crabs and various species of birds. The beach is constantly changing as the tide goes in and out, creating a dynamic environment for these living things. There are many examples of interdependence of living things in this environment, for example some crabs carry anemones on their shells as protection from predators, while the anemones get a free ride and access to food.

An abundance of shells, or parts of shells, can often be found on beaches. The shells are made by the animals that once inhabited them. These animals secrete calcium carbonate (a bit like tooth enamel) and other minerals to form a hard protective outer layer that enables them to defend themselves against predators and other environmental threats. When the animal dies, it decomposes and leaves an empty shell.

Climate change is important to note here as the ocean plays a critical role in regulating the Earth's climate. Rising sea temperatures, sea level change and ocean acidification can have significant impacts on marine ecosystems, including the living things in rock pools and on beaches.

3. What's for Dinner?

'What's for Dinner?' supports children to develop an appreciation of the interdependence of living things in a seashore habitat by looking for evidence of things that are alive or have once been alive. Based on their evidence of living things that they observe on the seashore, the children create food chains and food webs.

Learning outcomes

CONCEPTUAL UNDERSTANDING IN SCIENCE

The children will develop ideas about:

- ☑ The variety of animals and plants that live on the beach or in the sea;
- ☑ How some of the living things in these habitats depend on each other for survival;
- ☑ Food chains and food webs and how these are affected by changes to the environment.

KEY VOCABULARY

habitat
life cycle
nutrition
protection
food chain
producer
consumer
predator
prey
carnivore
herbivore
omnivore
fishing
pollution
key
branching key

WORKING SCIENTIFICALLY

Investigation types – this activity provides opportunities for:

- Identifying, grouping and classifying

Key skills the children might learn and apply:

- Asking questions
- Observing
- Recording data

Checklist: before you go to the beach

HEALTH AND SAFETY

- ☑ Carry out a full risk assessment.
- ☑ Check the tide times– going on a falling tide near low water is best, both for safety and to increase the likelihood of children observing a variety of animals and plants.
- ☑ Make sure that children are aware of The Seashore Code.

PRIOR DISCUSSION WITH THE CHILDREN

To get the most out of the activities at the beach, it is helpful if the children have had the opportunity to discuss their ideas about:

- What is meant by a habitat, and features of habitats that make them favourable or unfavourable for particular living things to survive;
- Features of a seashore habitat, including changes in tide height, salty water, exposure to wind, changes in temperature (with day and night, seasons and the tide), anchorage for roots;
- The animals and plants that they would expect to see at the beach and how they might be adapted to survive there, including where or how each living thing would obtain its food and protect itself;
- Food chains and food webs: what they are and how they help with illustrating one of the ways that living things depend on each other.

WHAT YOU NEED IN YOUR RESOURCE BUCKET

Essential:

- Mini pots for collecting items
- Hand lenses
- Paper and pencils

Optional:

- ID sheets/books
- Camera
- String

At the beach

WHAT TO DO

- Give the children boundaries for an area in which to look and prompt them to collect or record evidence of as many different living things as they can.
- As well as identifying living things such as seaweed, shrimps etc. encourage the children to think about evidence of something having once been alive, e.g. empty shells, crab claws or fishbones.
- Similarly, focus the children on looking for evidence of something that is still alive but where they might not actually be able to see it, e.g. sand coils made by sand worms, limpet shells stuck to rocks, or barnacles stuck to rocks and to other shells.
- Encourage the children to look carefully for shells. Some might be whole, but mostly they will have been crushed or chipped away by predatory crabs. Others may have been drilled by whelks, which will have left a clean circular hole.
- Give the children five minutes for quiet focused observation of seagulls and other birds as they forage and hunt along the shoreline. Ask the children to think about how the birds are moving and how this will help them catch food.
- Spend a further five minutes of quiet focused observation around a rock pool, looking carefully at the behaviour of any animals in the pool and how this is linked to trying to find food.
- Ask the children to think about the living things that they have identified, and how each one of them obtains its food. With older children, ask them to classify their living things into producers and consumers, and the latter group into carnivores, omnivores and herbivores.
- Ask the children to work in groups to put the living things they have identified into simple food chains. They could do this by using physical objects to represent living things, or by drawing.
- As children start to recognise the complexity of food chains, e.g. that there are several consumers that might eat the same producer, prompt the children to think about how they might represent this as a food web. They could do this physically with objects and bits of string, or by drawing.
- It might be helpful to take photographs of the different living things found, or the evidence for their existence, to use as prompts back in the classroom.

KEY QUESTIONS

- What sort of living things have you found on the seashore?
- What evidence have you found that suggests that something was once alive? Or that there is something alive, but you cannot actually see it?
- Where did you find the different living things or evidence for them?
- What do you notice about the behaviour of seagulls and other birds? What do you think they are doing?
- How does each living thing that you have found obtain its food?
- Can you group your living things into producers and consumers? What will eat what?
- Can you group your consumers into herbivores, carnivores and omnivores? Or into predators and prey?
- Look at your food chain, or food web: what would happen if one living thing died out, e.g. because of pollution at the beach? What effect would this have on the food chain/web?
- What if a new type of living thing came to live in the habitat? How would this affect the food chain or the food web? What might cause a new type of living thing to start living there?
- What events can you think of that will affect the seashore as a habitat? What will these mean for your food chain/web? How might the living things survive?

Finding living things in sand pools

Back in the classroom

EXTENDING LEARNING

- Use the photoraphs taken of different living things, or evidence of them, to create food chains and food webs.
- Explore 'taking out' one element of each food chain or food web and what impact this would have on the whole. Ask the children to consider what might cause a rise, or a drop in the numbers of a particular living thing in their food chain or web, and the impact that this would have.
- Consider the impact of pollution, human activity and other environmental changes on the food chains/webs of living things on the seashore.
- Find out about significant past events where a beach or seashore environment has radically been altered, e.g. a large oil spill from a big ship, and look at the impacts of this and how humans may have attempted to restore the habitat.

FURTHER RESOURCES RELATED TO 'WHAT'S FOR DINNER?'

Primary science teaching trust resources

- Science Fun at Home
  - World Oceans Day
- Science for One
  - Cup Chains (in 'Cup' activity sheet)
- I bet you didn't know
  - Red squirrels adapt to the food they eat; Biodiversity and trophic cascades

Explorify activities

- Have you ever ... seen an animal searching for food?
- What impact do our choices have on habitats?
- What if humans were not at the top of the food chain?
- Pointed predator
- Green producers
- Hunter and hunted
- Why do animals eat different things?

Background science for teachers

A food chain is a representation of a series of living things (or organisms) that depend on each other for food. It is a simple way to show how energy is transferred from one living thing to another. At the beach or seashore, there are many different organisms that make up a food chain. A basic example would be a food chain that starts with seaweed. Seaweed is a primary producer, which means that it makes its own food through photosynthesis. Small animals such as snails and crabs eat the seaweed, and they are called primary consumers. Then, larger animals such as birds or fish eat the snails and crabs, and they are called secondary consumers.

A food chain at the beach might look like this:

seaweed ⇨ snails/crabs ⇨ birds/fish.

A longer food chain might include a tertiary consumer and look like this:

seaweed ⇨ sea urchins/crabs ⇨ small fish ⇨ larger fish/seals

The arrows here signify 'is eaten by' and as such they show the transfer of energy (stored as food) from one living thing to the next.

A food web is a more complex version of a food chain. It shows how different food chains in an ecosystem or habitat are interconnected. At the beach or seashore, there are many different organisms that eat and are eaten by others, and these relationships can be represented in a food web. For example, in addition to the seaweed, there might be other primary producers such as algae or plankton. And instead of just one type of primary consumer, there might be several different animals that eat the seaweed, such as snails, crabs, and sea urchins. These animals can also be eaten by different types of secondary consumers, such as birds, fish, and seals. Some of these predators may themselves be preyed upon by even larger predators.

There are many factors that can affect food chains and food webs at the beach or seashore. Examples include:

Climate and weather – changes in temperature, rainfall, or storms can affect the availability of food for different living things.

Human activities – fishing, pollution and beach development can have a significant impact on the food web by disrupting the balance of different populations of living things.

Natural disasters – gales or even bad storms might cause sudden changes in the environment that can disrupt the food chain. Disasters caused by humans, e.g. oil spills from ships and, on a larger scale, rises in sea temperatures due to climate change can also have significant impacts on the stability of a food web.

Predation and competition – the balance of predator and prey populations is a key factor in the health and stability of a food web. Changes in the number of predators or prey can have ripple effects throughout the ecosystem.

Invasive species – the introduction of invasive species can upset the balance of a food web through successful competition with native species, or by introducing new predators or prey.

All of these factors can have a significant impact on the food chains and food webs at the beach or seashore. It's important to understand how these ecosystems work and what we can do to protect them from human impacts and other threats.

4. Clever Camouflage

'Clever Camouflage' encourages children to explore the seashore to find out about the animals that live there, how they are adapted to survive on the seashore and in particular how these adaptations enable them to camouflage themselves to blend in with their surroundings.

Learning outcomes

CONCEPTUAL UNDERSTANDING IN SCIENCE

The children will develop ideas about:

- ☑ The variety and types of animals that make their home on the seashore;
- ☑ How animals are adapted to survive on the seashore and how they protect themselves from predators;
- ☑ Features of animals that enable them to camouflage;
- ☑ How to look at a habitat without harming the living things in it.

KEY VOCABULARY

adaptation
habitat
environment
protection
food
survive
shelter
predator
prey
food chain
carnivore
herbivore
omnivore
camouflage
plus names of a range of seashore animals and plants

WORKING SCIENTIFICALLY

Investigation types – this activity provides opportunities for:

- Identifying, grouping and classifying investigation
- Research

Key skills the children might learn and apply:

- Asking questions
- Observing
- Recording data

Checklist: before you go to the beach

HEALTH AND SAFETY

- ☑ Carry out a full risk assessment.
- ☑ Check the tide times– going on a falling tide near low water is best, both for safety and to increase the likelihood of children finding evidence of animal camouflage.
- ☑ Make sure that children are aware of The Seashore Code.

PRIOR DISCUSSION WITH THE CHILDREN

To get the most out of the activities at the beach, it is helpful if the children have had the opportunity to discuss their ideas about:

- How animals are adapted to their environments to enable them to survive;
- The conditions particular to a seashore habitat and what adaptations of animals they might observe;
- How animals on the seashore might protect themselves from predators;
- Different ways in which animals camouflage themselves.

WHAT YOU NEED IN YOUR RESOURCE BUCKET

Essential:

- White trays or tubs
- Small measuring spoons, scoops or short-handled nets
- Hand lenses
- Paper and pencils

Optional:

- ID sheets/books
- Camera

At the beach

WHAT TO DO

- Give the children boundaries for an area in which to look, and encourage them to find evidence of as many different seashore animals as they can.
- Ask the children to record their findings by writing a list or drawing pictures.
- Prompt the children to work in pairs or small groups to identify which animals need to protect themselves from predators, and which animals need to hide from their prey in order to increase the chances of catching it.
- Encourage the children to observe a rock pool quietly for five minutes, taking note of any animals they see in the pool and how easy it is to spot them. After five minutes, suggest that they lift up stones and seaweed in the pool to observe if any animals emerge. Encourage them to look carefully, again taking note of how easy it is to spot them.
- Ask the children to make careful observational drawings of one or more of the animals that they have identified as potential prey and to focus on identifying the observable features that help to protect the animal from predators.
- Encourage the children to think about the colour of each animal and how this helps to protect it. Ask them to look carefully for variations in the colour of the animal, e.g. stripes, spots, patches, fades, and to think about why this is helpful for the animal. These variations may be very subtle or more contrasting; again, encourage the children to think about why this is.
- Prompt the children to consider where the animal is usually found and what this location looks like, and how well the animal blends in. Then encourage them to think about other places where the animal might need to go and how well it will be camouflaged in the new location.
- Encourage the children to fill a tray or tub with water from a rock pool and to scoop out one or more animals from the rock pool to observe them more closely.
- Prompt the children to make a detailed observational drawing of one animal, showing how its features and colour enable it to camouflage itself to protect itself from predators.
- It might be helpful to take photographs of some of the animals found to use as a prompt back in the classroom.

KEY QUESTIONS

- What sort of animals have you found on the seashore?
- Where did you find most of the animals? Why do you think this is?
- What is it like for the animal in its habitat? What are the dangers for it? What might want to eat it? What might it want to catch for itself to eat?
- How does the animal protect itself? What adaptations does it have to enable it to survive?
- What colour is the animal? Does the colour vary? Why might this be?
- What animals have you identified that are well camouflaged?
- What animals have you identified that are not very well camouflaged? What other features do these animals have that help them to survive?
- What do you think might happen to the animals that are well camouflaged when they move to a different location?

A well-camouflaged crab, adapted to survive on a rocky beach.

Back in the classroom

EXTENDING LEARNING

- Use drawings from the beach and any photographs taken of different animals to create new annotated illustrations.
- Create a whole class display of a giant rock pool where each child/group contributes a drawing of something that lives in the rock pool, with labels and annotations added.
- Find out about other habitats and how animals use camouflage to protect themselves, and compare these findings with what they found out about animals at the seashore.
- Cut out a set of paper 'moths' and colour them in different ways. Stick the moths onto a wall outside and investigate how many of them can be counted from different distances away from the wall. Consider the findings and what provides the most effective camouflage, e.g. the actual colour, or variations in the colour.

FURTHER RESOURCES RELATED TO 'CLEVER CAMOUFLAGE'

Primary science teaching trust resources

- **Starters for Science**
  - Animal camouflage
- **Science Fun at Home**
  - Roald Dahl Day (camouflage activity)
- **I bet you didn't know**
  - Stripes and Concealment

Explorify activities

- **Have you ever ... found it difficult to spot an animal because of its colour?**
- **Make a mark**
- **Confusing camouflage**
- **If you see me now**
- **Grey and black**

Background science for teachers

Camouflage is a way for animals to hide themselves from predators or prey by blending in with their surroundings. Through evolution, these animals have become adapted to survive in their habitat, and this includes being camouflaged. A well camouflaged animal is more likely to survive and bear offspring than a less well camouflaged animal, so this adaptation will continue through to the next generation of the species. Or conversely, a poorly camouflaged animal is likely to be eaten, or to be unable to catch food, and so unlikely to survive to pass on its poor adaptation to any offspring.

In a rock pool, animals that are well camouflaged can hide themselves among the rocks and algae to avoid being eaten or to sneak up on their own prey. For example, a crab might have a shell that looks like a rock or have patterns on its body that help it blend in with the surrounding rocks and algae, making it harder for predators such as birds or fish to spot them. Similarly, a small fish might have colours that match the rocks and algae around it, making it harder for other fish to see and attack it. Mottled colours or patterns break up the body shape of the animal which makes them less noticeable than if they had a solid colour. Some animals, e.g. the octopus, have evolved to be able to change the colour of their skin to match their surroundings. Other animals might have a paler underside than topside so that when viewed from below, they are harder to see against the lighter water above.

As well as camouflage, seashore animals have other features that protect them from predators or help them catch food.

Shells – many seashore animals have hard shells that protect them from predators, e.g. snails and clams have hard shells that can be tightly closed to prevent predators from getting to them.

Poison – some seashore animals have evolved to produce toxic substances that make them unappetising or even deadly to predators, e.g. some species of sea slugs have bright colours that warn predators that they are toxic.

Speed – some seashore animals have evolved to be very fast and agile, making it difficult for predators to catch them, e.g. sandpipers are very quick and can run away from predators on the beach.

Burrowing – some seashore animals have adapted to burrow into the sand or mud to hide from predators, e.g. many types of crabs dig burrows in the sand where they can hide from predators.

Anchoring – many animals on the seashore attach themselves to rocks and often grow in colonies, e.g. barnacles. This is because the sea contains all they need to survive and they have adapted to be able to catch food from water when they are submerged, while protecting themselves from predators.

5. Save Our Seashore

'Save Our Seashore' encourages children to think about how the actions of humans affect life on the seashore. They will learn about Marine Conservation Zones and consider the purpose of these, before choosing an area of the seashore that they would choose to designate as a conservation zone, giving justifications for their choices.

Learning outcomes

CONCEPTUAL UNDERSTANDING IN SCIENCE

The children will develop ideas about:

- ☑ The variety of animals and plants that inhabit the seashore and the nature of the relationships between them;
- ☑ Common human activity at the seashore and how this affects the natural life there;
- ☑ How a seashore habitat might be protected from the impacts of human actions;
- ☑ How scientists work together to try and protect our natural environments;
- ☑ How to look at a habitat without harming the living things that live in it.

KEY VOCABULARY

habitat
environment
protection
conservation
pollution
habitat destruction

WORKING SCIENTIFICALLY

Investigation types – this activity provides opportunities for:

Research
Problem solving

Key skills the children might learn and apply:

Observing and measuring
Recording data

Checklist: before you go to the beach

HEALTH AND SAFETY

- ☑ Carry out a full risk assessment.
- ☑ Check the tide times – going on a falling tide near low water is best, both for safety and to maximise the area that the children can explore.
- ☑ Make sure that children are aware of The Seashore Code.

PRIOR DISCUSSION WITH THE CHILDREN

To get the most out of the activities at the beach, it is helpful if the children have had the opportunity to discuss their ideas about:

- Features of a seashore habitat, the animals and plants that live there and how these survive;
- Human activity on the seashore and how this might impact the living things there;
- How humans can prevent damage to seashore habitats, including mitigating against natural disasters;
- Marine Conservation Zones (MCZ), how these serve to protect the seashore, and the criteria for an area being designated in need of protection;
- Whether the beach to be visited is already a designated MCZ;
- What evidence there might be at the seashore to show that it is part of, or not part of a designated MCZ and where it isn't, what indicators there might be that it is worthy of a designation.

A Marine Conservation Zone is a designated area of sea or ocean that is managed for the conservation and protection of marine life and habitats. These zones are established by governments and are typically located in areas that are of particular ecological importance or that contain unique or rare marine species or habitats. The aim of MZCs is to protect and enhance the marine environment for the long-term benefit of both the environment and the people who rely on it. They provide a range of benefits, such as protecting important habitats, preserving biodiversity, promoting sustainable fisheries, and providing recreational opportunities.

In the UK, MCZs are designated and managed by the Government's **Marine Management Organisation (MMO)** and **Natural England**. The **Marine Conservation Society** has useful information about MZCs, including a map of the UK showing the location of all the conservation areas identified.

WHAT YOU NEED IN YOUR RESOURCE BUCKET

Essential:

- Paper and pencils
- String circles (1-2 metres in diameter)

Optional:

- ID sheets/books
- Camera

At the beach

WHAT TO DO

- Give the children boundaries for an area in which they can look and ask them to find as much evidence as they can of human activity on the seashore or beach. This might include evidence as a result of:
  - Pollution, e.g. litter dropped on the beach, rubbish and other items dropped from boats and washed in from the sea, run-off or overflows of contaminated water (pesticides, fertilisers, sewage) from the land (NB there are many pollutants, e.g. sunscreen, where the effects might not be visible but are worth discussing with the children);
  - Erosion, e.g. overuse of the beach, degradation of sand dunes due to excessive walking, waves made by boats close to the shoreline;
  - Development, e.g. new buildings on or near the seashore;
  - Climate change, e.g. rising sea levels and increased sea temperatures leading to a change in the types and relative numbers of species found.
- Prompt the children to find a rock pool (or part of the beach or shoreline) to investigate and encourage them to observe it carefully without disturbing it and to identify as many different plants and animals as possible. Ask the children to think about the features of the habitat that they are observing and how the living things survive.
- Encourage the children to think about all the evidence they found of human activity and how this might impact the survival of the living things that they have identified.
- Ask the children to take on the role of an environmental scientist whose job is to decide whether a particular area should become a designated MCZ.
- Suggest to the children that they select a rock pool or other small area of the seashore where they have found living things and mark it out with a string circle.
- Encourage the children to build explanations of why they consider that the habitat encircled by the string needs to be protected. Prompt them to relate their ideas to the evidence of human activity that they have found on the seashore.
- Encourage the children to consider the effects of human activity, not just on one particular animal or plant, but also the knock-on effects on all the living things in the habitat.
- It might be helpful to take photographs of the children's string circle areas to use as prompts back in the classroom.

KEY QUESTIONS

- What can you see that tells you that humans have been on this beach?
- Can you see anything that shows that humans have walked on the beach or in the dunes?
- What can you see that you think might have been washed ashore from a boat?
- What other things that you can't actually see might cause pollution at the seashore?
- What do you think are the effects of pollution by chemicals?
- What do you think are the problems arising from litter on the beach?
- Why do you think the living things in your string circle need designated protection?
- What sort of human activity is threatening them? How could this be prevented?

Rubbish on the strandline

Back in the classroom

EXTENDING LEARNING

- Use the photographs taken of the string circle areas for children to continue their discussions about protecting living things on the beach from human activity.
- Create protection guides or seashore codes for their particular area chosen.
- Find out more about the amount of litter that comes from boats and gets washed up on beaches and research the impact of this on life on the seashore and in the oceans.
- Find out more about how beaches are polluted from run-off or overflows of contaminated water, including sewage and microplastics.

FURTHER RESOURCES RELATED TO 'SAVE OUR SEASHORE'

Primary science teaching trust resources

- **Science Fun at Home**
  - Scavenger Science
- **I bet you didn't know**
  - Urban evolution

Explorify activities

- **Have you ever ... seen rubbish where it shouldn't be?**
- **Beavering away**
- **What impact do our choices have on habitats?**
- **Pollution everywhere**

Background science for teachers

Human impact on seashores can be quite significant and can have far-reaching consequences for the marine ecosystem, and for the people who depend on it. There are many ways in which human activities can affect seashores.

Pollution – Human activities can lead to pollution of the oceans, which can have devastating effects on seashores. Polluted water can kill off marine plants and animals, disrupt food chains, and even make people sick if they swim in or eat seafood from polluted waters. Pollution can be from a range of sources, including land run-off, sewage discharges, sunscreen, litter, or items washed ashore that have been discarded from boats.

Development – Seashores are often prime locations for development, such as building homes, hotels and resorts. This can lead to habitat destruction, erosion and alteration of the natural landscape.

Overfishing – Overfishing can deplete fish populations, which can have cascading effects on the entire marine ecosystem. This can lead to the collapse of entire fisheries and loss of biodiversity.

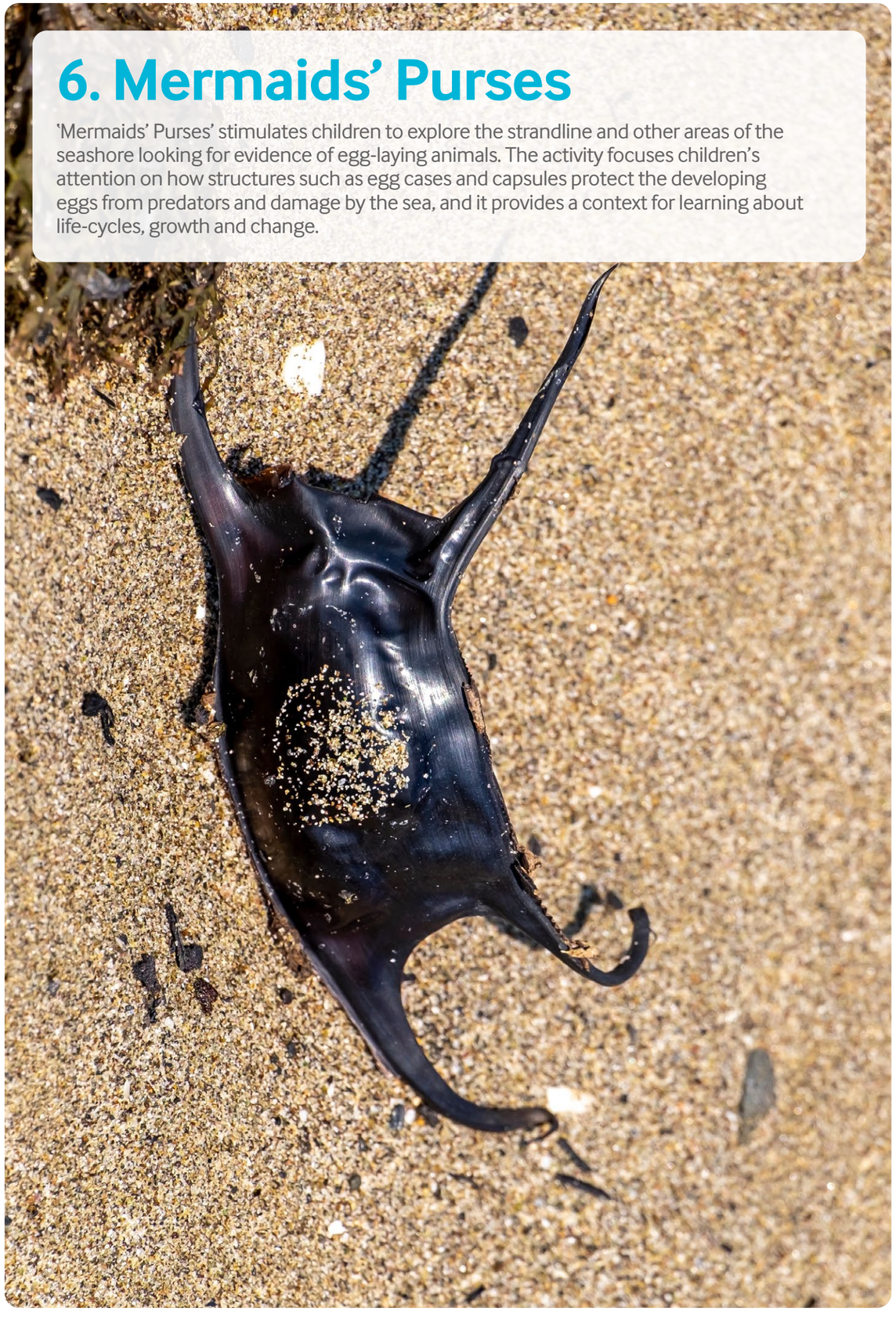
Climate change – Climate change is causing sea levels to rise and ocean temperatures to warm, which can have significant impacts on seashores. Rising sea levels can lead to increased erosion and flooding, while warmer water temperatures can lead to the loss of important marine habitats such as coral reefs, or the disruption to food chains by the colonisation of new species or increased/decreased numbers of existing species.

Recreational activities – Boating, swimming, fishing and other recreational activity can also have impacts on seashores. For example, boat anchors can damage seagrass beds, which are important habitats for many marine species.

In England, nationally important habitats and species are protected through Marine Conservation Zones (MCZs). There are about 90 MCZs around the coast of the UK. They protect the special features of each site from certain damaging activities. Because each MCZ is unique, they are managed in different ways. Potential effects of any damaging activities (such as dredging and trawling) are assessed and if any is found to pose a significant risk to the special features of a site, that activity will no longer be permitted. One example of this is the Manacles MCZ on the southern coast of Cornwall which was set up in 2013. The banning of bottom trawling in this area is protecting a number of seabed features including spiny lobster, stalked jellyfish and delicate beds of a seaweed called maerl. The latter forms a type of reef that provides a home for many other species. Evidence has shown that protecting such areas allows the wildlife to recover and thrive.

6. Mermaids' Purses

'Mermaids' Purses' stimulates children to explore the strandline and other areas of the seashore looking for evidence of egg-laying animals. The activity focuses children's attention on how structures such as egg cases and capsules protect the developing eggs from predators and damage by the sea, and it provides a context for learning about life-cycles, growth and change.



Learning outcomes

CONCEPTUAL UNDERSTANDING IN SCIENCE

The children will develop ideas about:

- ☑ Which marine and seashore animals lay eggs;
- ☑ How these animals protect their eggs from predators and damage by the sea;
- ☑ The structures of some types of egg cases or capsules;
- ☑ Life-cycles, in particular of marine and seashore animals;
- ☑ How to look at a habitat without harming the living things that live in it.

KEY VOCABULARY

egg
sperm
egg case
capsule
lay
hatch
male
female
reproduce
fertilise
life-cycle
protect
camouflage
predator
larva
embryo
shark
skate
ray
crab
fish

WORKING SCIENTIFICALLY

Investigation types – this activity provides opportunities for:

- Pattern seeking
- Identifying, grouping and classifying

Key skills the children might learn and apply:

- Asking questions
- Observing and measuring

Checklist: before you go to the beach

HEALTH AND SAFETY

- ☑ Carry out a full risk assessment.
- ☑ Check the tide times – going on a falling tide near low water is best, both for safety and to ensure that the strandline is accessible and other areas of the beach are exposed and can be easily explored.
- ☑ Make sure children are aware of The Seashore Code.

PRIOR DISCUSSION WITH THE CHILDREN

To get the most out of the activities at the beach, it is helpful if the children have had the opportunity to discuss their ideas about:

- What they might find at the beach that is alive, has once been alive or has never been alive;
- Life-cycles of animals and about animals that lay eggs;
- How animals might protect their eggs – it is recommended that children are shown pictures of mermaids' purses and other egg cases or capsules that they might find on the beach;
- How scientists draw conclusions from their observations and from evidence of things that they find.

WHAT YOU NEED IN YOUR RESOURCE BUCKET

Essential:

- Collecting bags or trays
- Hand lenses
- Protective gloves

Optional:

- ID sheets/books
- Camera

At the beach

WHAT TO DO

- Encourage the children to explore the strandline, looking very carefully for items that they find interesting and, in particular anything that they think might be an egg case or capsule, or part of one.
- Suggest to the children that they use hand lenses to look closely at what they have found and try to identify what it might be, starting with considering if it is alive, was once alive or has never been alive.
- Tell the children that they can collect the once alive/never alive things they have found in their bag or tray, but that they should be careful not to disturb anything that is living.
- When children find a mermaid's purse or other egg case or capsule, ask them to show the whole group and encourage them to consider what it is made from, its shape, size and how it would have protected the animals' eggs.
- Encourage the children to look more closely at the mermaid's purse and identify features such as tendrils, horns and the opening from where the young animal will have emerged.
- Prompt the children to consider how the animal will survive after hatching from the capsule and compare this with other animals that they know that lay eggs and how their offspring survive, e.g. chickens, or insects such as butterflies.
- Continue the discussion to include comparisons with non-egg laying animals, e.g. humans, or other mammals such as cats or dogs that they may be familiar with.
- It might be helpful to take photographs of the items found in different locations on the seashore to use as a prompt back in the classroom.

KEY QUESTIONS

- What have you found that you think was once alive? Why do you think this?
- What is the mermaid's purse/egg case made from? How do you think that it was made?
- What features can you see on the mermaid's purse/egg case? Why do you think they are there?
- How does the mermaid's purse/egg case protect the developing young? What difference does the colour make? What about the material that it is made from?
- Why do you think people call the egg cases of some sharks, skates or rays mermaids' purse?
- Why do some seashore animals lay their eggs inside an egg case or capsule such as a mermaid's purse?
- How did the empty mermaid's purse/egg case end up on the beach?
- Where do you think the parent animals that laid the eggs are now?
- Can you think of any other animals that lay eggs? How do they protect them?
- How do other animals survive once they have hatched out of an egg? How does this compare with the marine animals that you are finding out about?
- How do other animals that don't lay eggs protect their new-born young?
- Why do you think that fish that lay their eggs straight into the sea usually lay hundreds of eggs?

Looking for mermaids' purses along the shoreline

Back in the classroom

EXTENDING LEARNING

- Use the actual items collected and/or photographs taken of different things found on the beach to sort and classify them into things that have once been alive and have never been alive.
- Focus on a shell and encourage the children to think about what it is made from and how it was made, before debating, with evidence for their ideas, whether they consider it is alive, once alive or never alive.
- Make close observational drawings of mermaids' purses and/or other things that they have found on the seashore and brought back to the classroom.
- Find out more about the life-cycles of different fish. In groups the children can take one type of fish each and create a pictorial representation of its life-cycle to add to a whole class display.
- Make a classification key for the items that they have found on the beach.
- Design a protective casing for an animal of their choice and explain how it will protect the developing embryo from damage or predators.

FURTHER RESOURCES RELATED TO 'MERMAIDS' PURSES'

Primary science teaching trust resources

- Science Fun at Home
  - Body Science
- I bet you didn't know
  - How to calculate the age of a shark; Stripes and concealment

Explorify activities

- Have you ever .... noticed how babies change as they become toddlers?
- Unexpected eggs
- Looking after baby
- Grey and black
- In the swim

Background science for teachers

Mermaids' purses are the egg cases of certain species of sharks, skates and rays. These egg cases are often referred to as purses because of their oblong shape and the way in which they are often found washed up on beaches.

Most fish reproduce through external fertilisation, where the female and male release large numbers of eggs and sperm into the sea. Once fertilised, the eggs develop a tough gelatinous coating that helps protect the developing embryos from physical damage and predators. Some fish reproduce through internal fertilisation which either results in the fish giving birth to live young, or in the fish laying fertilised eggs. Some species of shark, skate and ray are examples of fish that lay eggs that have been fertilised inside the female's body. Once laid, these eggs develop a thin membrane around them that becomes coated in layers of a tough, leathery material called keratin. These layers eventually harden to form an egg case, or mermaid's purse, to protect the developing embryos. Keratin is the same material that makes up human hair and nails, as well as the scales, fins and teeth of sharks, skates and rays.

The size and shape of the egg case can vary depending on the species of shark, skate, or ray that laid it. Some species, such as the nurse shark, produce egg cases that are relatively large and rectangular, while others, like the dogfish shark, produce smaller and more elongated egg cases. The number of eggs that develop in a mermaid's purse can vary depending on the species of shark, skate, or ray that laid it. For example, some species of skates can lay up to 50 or more eggs in a single mermaid's purse, while other species of sharks may only lay one or two eggs at a time.

Once the egg case is complete, the female will typically attach it to a surface such as a rock or piece of seaweed. The egg case will then be left to incubate, with the developing embryo receiving oxygen and nutrients from the surrounding water. After several months, the embryo will hatch from the egg case and emerge as a juvenile shark, skate, or ray. Empty egg cases will often wash up on beaches, where they can be collected by beachcombers and used for educational purposes.

Other animals found in rock pools reproduce in a variety of ways, depending on the species.

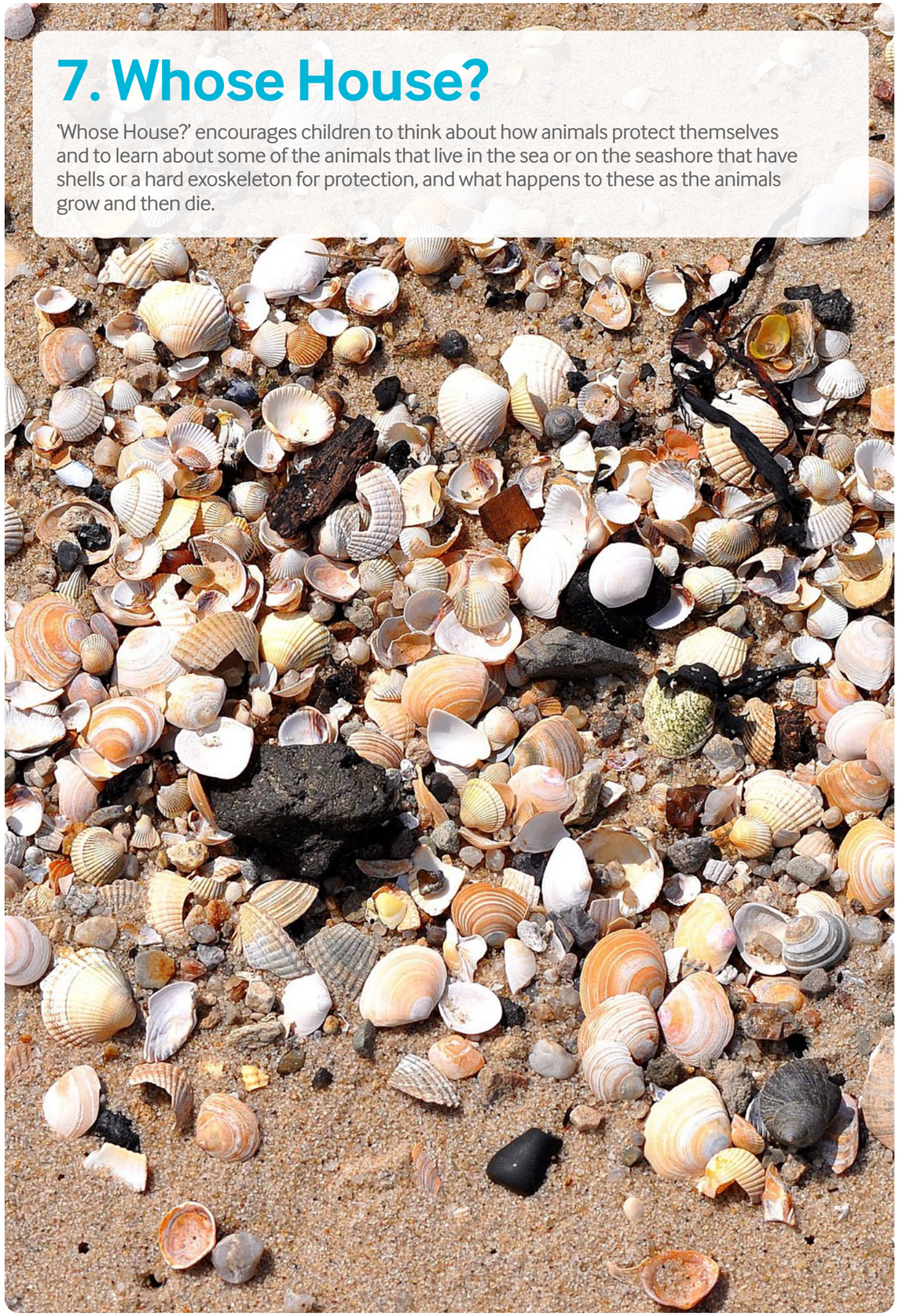
Most crabs and shrimps reproduce sexually, with males and females mating to produce offspring. Female crabs will typically carry fertilised eggs in their abdominal sac until they hatch into larvae. Some species of crabs, such as the green crab, can also reproduce asexually through a process called parthenogenesis, in which unfertilised eggs develop into viable embryos.

Snails also reproduce sexually. After mating, the female snail will typically lay eggs in a protected location, such as under a rock or in a crevice. The eggs will hatch into larvae, which will eventually develop into juvenile snails. The dog whelk, a carnivorous sea-snail, lays its eggs inside small yellow capsules in rocky crevices. The much larger common whelk inhabits a rocky or gravelly sea bed. The females lay clusters of fertilised eggs, which develop in yellow capsules on rocks or seaweed. Once the baby whelks have hatched, the empty egg capsules are often found washed up on the strandline. Worm pipefish – a fish from the same family as the seahorse – can sometimes be found in rock-pools. As with the seahorse, it is the male who carries and gives birth to live young.

In addition to sexual reproduction, some rock pool animals, such as sea anemones and starfish, are capable of asexual reproduction through processes such as fragmentation, budding, or regeneration. For example, some species of starfish can regenerate lost limbs or split in two to form two separate individuals.

7. Whose House?

'Whose House?' encourages children to think about how animals protect themselves and to learn about some of the animals that live in the sea or on the seashore that have shells or a hard exoskeleton for protection, and what happens to these as the animals grow and then die.



Learning outcomes

CONCEPTUAL UNDERSTANDING IN SCIENCE

The children will develop ideas about:

- ☑ What type of animals have shells and how the shells protect them;
- ☑ How animal shells are made, what happens to them as the animal grows and when it eventually dies;
- ☑ The formation and composition of sand and shingle on a beach;
- ☑ How to look at a habitat without harming the living things that live in it.

KEY VOCABULARY

snail
mollusc
crustacean
urchin
bivalve
exoskeleton
endoskeleton
shell
protect
predator
prey
survive
adaptation
habit
environment

WORKING SCIENTIFICALLY

Investigation types – this activity provides opportunities for:

- Identifying, grouping and classifying investigation
- Research

Key skills the children might learn and apply:

- Asking questions
- Observing
- Recording data

Checklist: before you go to the beach

HEALTH AND SAFETY

- ☑ Carry out a full risk assessment.
- ☑ Check the tide times – going on a falling tide near low water is best, both for safety and to maximise the area that the children can explore.
- ☑ Make sure that children are aware of The Seashore Code.

PRIOR DISCUSSION WITH THE CHILDREN

To get the most out of the activities at the beach, it is helpful if the children have had the opportunity to discuss their ideas about:

- How animals protect themselves from predators and shelter from adverse conditions;
- Humans and other vertebrates, whose endoskeletons provide support, protect organs and enable movement, compared with animals that don't have endoskeletons;
- How invertebrate animals bodies are supported and protected and how they move;
- Examples of invertebrate animals that live at the sea and whether they have exoskeletons, shells or neither of these;
- What happens to animal shells when the animal dies.

WHAT YOU NEED IN YOUR RESOURCE BUCKET

Essential:

- White trays or tubs
- Hand lenses
- Paper and pencils

Optional:

- ID sheets/books
- Camera

At the beach

WHAT TO DO

- Challenge the children to find different types of shell. Give them boundaries and encourage them to look in different areas of the seashore.
- Ask them to collect the shells – both whole and fragments – in their trays or pots.
- Prompt the children to sort their shells into groups according to criteria of their own choosing.
- Where the children have collected shell fragments, ask them if they can work out what the original whole shell would have looked like.
- Discuss what kind of animals they think lived in the various shells and why they think this.
- Encourage the children to look in rock pools to see if they can find examples of shells that are the same as the ones they found, but with the animal still living in them.
- Remind the children that some of the animals that live in a shell in a rock pool are very tiny so they need to look really carefully.
- Suggest to the children that they make drawings in the sand of what they think the animals living in their shells looked like and to challenge other children to match the drawings to the shells.
- Ask the children to observe the shingle again and describe its composition, taking note of the different types and quantities of rocks, small pebbles, sand, shell fragments etc. that they can see.
- Discuss in groups whether they would like to live in a shell and what the advantages and disadvantages would be.
- If the children are going to take home some of the shells and shell fragments, they should be rinsed in clean water.
- It might be helpful to take photographs of the shells that the children collected to use as prompts back in the classroom.

KEY QUESTIONS

- What kind of animals live on the seashore?
- How do they protect themselves from being eaten by predators or being damaged by waves and rocks?
- Which seashore animals can you think of that have shells?
- Which seashore animals can you think of that don't have shells, but have a hard skeleton on the outside of their bodies?
- How many different types of shell can you find?
- How many whole shells have you found? Why are so many shells not whole any more, but are broken into pieces?
- Can you work out from a shell fragment what the whole shell would have looked like?
- Do you think that the shell provides good protection for the animal?
- Would you like to live in a shell? What would be good about it, or bad about it?

A hermit crab using an empty shell to protect itself

Back in the classroom

EXTENDING LEARNING

- Discuss what it would be like to live in a shell and what sort of shell would be best or worst.
- Create a branching key using the actual shells and shell fragments or the photographs of them.
- Compare seashore shells with shells of land animals, e.g. snails. Encourage the children to observe and consider similarities and differences between them and the reasons for these.
- Discuss how the animals they found that live in shells at the seashore are adapted to their habitat.
- Find out more about the different composition of rocks, small pebbles and shingle found on beaches.
- Research how a seashore animal makes its shell and what it is made from.
- Discuss whether an animal's shell is alive, was once alive or has never been alive.

FURTHER RESOURCES RELATED TO 'WHOSE HOUSE?'

Primary science teaching trust resources

- **Science Fun at Home**
  - Roald Dahl Day (camouflage activity), Scavenger Science
- **Starters for Science**
  - Animal Camouflage
- **I bet you didn't know**
  - Red squirrels adapt to the food they eat, Biodiversity and trophic cascades

Explorify activities

- **Have you ever ... picked up a rock you found and put it in your pocket to take home?**
- **Have you ever watched a small animal in its habitat?**
- **Animal remains**
- **Brown and bumpy**
- **Get a backbone!**
- **What can't fish live on land?**

Background science for teachers

Many animals that live on the seashore have evolved some sort of hard shell or casing to protect themselves from the environment, preventing them from being damaged by the action of waves or from drying out when the tide goes out, and protecting them from being eaten by predators.

Seashore animals that have a hard outer protective shell made of minerals are called 'shelled' animals or molluscs, e.g. clams, sea snails and oysters. These animals typically have a soft body composed of a head, visceral hump, mantle and foot. The shells of molluscs are formed through a process called biomineralisation. The animal produces minerals such as calcium carbonate which is secreted by their mantle. As more calcium carbonate is secreted, a solid shell is formed. The precise mechanism of shell formation varies among different seashore animals. For example, in bivalve molluscs such as clams and oysters, the mantle tissue secretes calcium carbonate in the form of thin, overlapping, hinged plates that gradually fuse together to form a complete shell. In contrast, in gastropod molluscs like snails, the shell grows in a spiral pattern.

Other types of seashore animal, such as crustaceans like crabs, lobsters and shrimps, don't have a shell, but instead have a hard outer protective structure called an exoskeleton. Unlike a shell, an exoskeleton is jointed to aid the movement of the animal. Exoskeletons are usually made of a protein called chitin. As a crustacean such as a crab grows, it needs to shed this hard shell. This process is called moulting. Crabs moult their entire exoskeleton and this, or parts of it, can often be found along the seashore, along with the shells or shell fragments of animals no longer living. As empty shells are moved by the action of waves, they become broken into smaller pieces and eventually form part of the sand on the beach.

Sea urchins have a hard exoskeleton or shell as well as hard spines to protect their soft body. Empty sea urchin shells are quite brittle, but may be found along the seashore. Hermit crabs live inside the empty shells of sea snails or other animals. As they grow, they need to find ever larger shells to move into. Sometimes a shell such as that of a limpet or mussel may be found with a tiny, perfectly round hole in it. This has probably been made by a carnivorous sea snail called a dog whelk. It drills or bores a hole in the shells using its radular, then injects enzymes through the hole to digest the body of its prey inside its shell before sucking out the resulting liquid soup.

Many animals in the sea attach themselves to rocks and grow in colonies. This is because the sea is contains all they need to survive and thrive, and being attached to a rock helps them to stay protected. These animals have adapted a variety of methods for capturing food from the water.

Many people enjoy 'beachcombing' – looking for interesting items along the seashore and collecting empty seashells. Whilst it is permitted to collect some empty shells from the beach, it is important to check that there is no animal still living inside. Note also that anything living attached to a hard surface should not be removed as the animal may not survive.

8. Going, Going, Gone?

'Going, Going, Gone?' gives children the opportunity to explore the strandline looking for natural and manufactured objects and, in particular things that have been washed up by the tide. The children can then sort their collection of objects in a variety of ways, including according to how long each will take to decompose (if at all) before considering how the objects will impact on the living things at the seashore.

Learning outcomes

CONCEPTUAL UNDERSTANDING IN SCIENCE

The children will develop ideas about:

- Whether objects are manufactured or natural and their criteria for deciding;
- Different materials that objects are made from;
- The variety of objects that are washed up by the tide and where these might have come from;
- How long different materials take to decompose, if at all;
- The consequences for living things at the seashore of materials that are not biodegradable being washed in by the tide;
- The impact of human behaviour on the seashore environment.

KEY VOCABULARY

strandline
manufactured
natural
biodegradable
decompose
tide
wave
current
wind
pollution

WORKING SCIENTIFICALLY

Investigation types – this activity provides opportunities for:

- Identifying, grouping and classifying investigation
- Research

Key skills the children might learn and apply:

- Asking questions
- Observing
- Recording data

Checklist: before you go to the beach

HEALTH AND SAFETY

- Carry out a full risk assessment.
- Check the tide times – going on a falling tide near low water is best, both for safety and to ensure that the strandline is fully exposed and can be explored.
- Make sure that children are aware of The Seashore Code.

PRIOR DISCUSSION WITH THE CHILDREN

To get the most out of the activities at the beach, it is helpful if the children have had the opportunity to discuss their ideas about:

- The difference between natural and manufactured objects and materials, and between things that are alive, were once alive and have never been alive;
- Tides and why debris and rubbish from ships at sea often washes up on beaches;
- Which types of materials are biodegradable and which are not and how long it takes different materials or objects to decompose;
- How different materials, and the products of their decomposition, might be harmful to living things on the seashore.

WHAT YOU NEED IN YOUR RESOURCE BUCKET

Essential:

- Collecting bags or small trays
- Hand lenses
- Protective gloves

Optional:

- Camera

At the beach

WHAT TO DO

- Give the children boundaries for lengths of the strandline and encourage them to look for items that they find interesting and to collect these in their trays or bags.
- Suggest to the children that they try to collect a variety of items, including things they think are natural and things that they think have been manufactured.
- Focus the children on describing the features of the items that they have collected, using hand lenses to look in more detail.
- Ask the children to make a group collection of their items and then sort their larger collection into groups according to their own criteria, e.g. natural/manufactured, by colour, by material, by function of the object etc.
- Prompt the children to sort the items into manufactured and natural and to discuss the origins of the items in each group.
- Prompt the children to place the items into a line in an order to show how long they think it will take for them to decompose. Encourage them to estimate the time for different items to decompose.
- Encourage the children to observe and discuss the order of items that other groups have made and to look for similarities and differences between these lines and their own group's line.
- Ask the children to identify the items that they think will be harmful to living things on the seashore and explain why they think this.
- Discuss with the children how humans could change their behaviour to prevent harmful non-biodegradable items being washed up by the tide onto the beach, or left there as litter.
- It might be helpful to take photographs of how the children sorted and ordered their items so they can be used as prompts for further discussion back in the classroom.

KEY QUESTIONS

- What sort of items have you found? What materials are they made from?
- Are they natural or manufactured? How do you know?
- How could you sort your items into groups?
- Where do you think your items have come from? Why do you think this?
- How long do you think your items might have been in the sea? Why do you think this?
- What will happen to your items? Why do you think this?
- Which of your items do you think are biodegradable? Which of your items will naturally decompose? How long do you think this will take?
- How do you think the items you found affect the living things on the seashore? Are any of them harmful to seashore life? How are they harmful?
- What could humans do to change their behaviour to prevent litter being left on the beach and items being washed up by the tide?

Erosion of cliffs

Back in the classroom

EXTENDING LEARNING

- Use the photographs taken of the lines of items to create a timeline of decomposition that can be displayed.
- Research how long it takes different materials to decompose.
- Investigate how long it takes items such as apple cores or orange peel to decompose in fresh water, in salt water and in air.
- Research the effects of different items in the ocean or washed up onto the beach by the tide on living things on the seashore, and propose a 'code' to help humans change behaviour to reduce harmful effects – similarly with litter that is left on the beach.
- Discuss the advantages and disadvantages of using glass bottles versus plastic bottles and why glass is less detrimental to marine life.

FURTHER RESOURCES RELATED TO 'GOING, GOING, GONE?'

Primary science teaching trust resources

- **Science Fun at Home** - World Oceans Day, Scavenger Science
- **Bringing Back Glass** - A set of practical activities to help children explore the use of glass in everyday life
- **I bet you didn't know** - Plastics in soil

Explorify activities

- **Have you ever ... seen rubbish where it shouldn't be?**
- **Clean up the beach**
- **Totally organic**
- **Glorious grains**

Background science for teachers

The strandline, also called the tideline, is the line or mark left on a beach by the highest point of the tide. It is often seen as a distinct area or band where items have been carried up the beach and deposited by the tide at high water. This debris is then left behind when the tide goes out again. The strandline is an important habitat for marine animals and feeding birds, and it is often teeming with life, e.g. creatures such as sand hoppers and fly larvae (maggots). These play an important role in breaking down natural waste, and they also provide a food source for overwintering birds. Other items may end up in the strandline, such as litter left on beaches. Materials that wash up on beaches, or are dropped there as litter, can have significant effects on living things, both in the water and on land. The impact of materials that wash up on beaches on living things can be severe and long-lasting, both in the short-term and over longer periods of time.

Plastics are one of the most common materials that wash up on beaches. They can pose a serious threat to marine animals, such as turtles, whales and seabirds, who can mistake them for food or become entangled in them. Once ingested, plastics can cause injury or death by blocking the digestive tract or releasing toxic chemicals into the animal's body. Ocean currents can result in plastic items being transported thousands of miles and over a long period of time. An example case study is the **rubber ducks lost at sea** incident. Plastic waste from the UK can end up washed up on the other side of the world or stuck in 'ocean gyres' - areas where ocean currents come together which concentrates plastics into 'islands' of rubbish in the middle of the ocean.

Evidence of oil spills and leaks can sometimes be seen on the strandline. These can cause extensive damage to marine ecosystems, including beaches. Oil can coat the feathers of seabirds, making it difficult for them to fly or stay warm. It can also harm fish, shellfish and other marine animals, affecting their ability to breathe, feed and reproduce. Other chemicals from industrial or agricultural sources can also be washed onto beaches and into the water, contaminating the environment and harming living things. Chemicals can disrupt the hormone systems of animals, affecting their growth and reproduction, or can be toxic, causing illness or death.

Other types of debris, such as fishing nets, ropes and lines, can pose a hazard to marine animals by causing entanglement or strangulation. This can lead to injury or death by suffocation or drowning. Note that often manufactured items that have been washed up on beaches may have become homes for animals adapted to live on floating marine objects, and this should be considered if 'rubbish' is being removed from the beach.

It is essential to take steps to reduce our reliance on single-use plastics, prevent oil spills and leaks, and properly dispose of hazardous materials to minimise the negative effects on our environment and its inhabitants.

Length of time scientists think it takes for some everyday objects to decompose

Apple core	1-2 months
Cardboard box	2 months
Orange peel	6 months
Cigarette butt	10 years
Wood	10-15 years
Tin can	50 years
Crisp packet	80 years
Plastic bag	10-100 years
Aluminium drinks cans	80-100 years
Wet wipes	100 years
Polyester clothing	20-200 years
Disposable nappy	100-500 years
Plastic drinking straw	100-500 years
Fishing line	600 years
Plastic bottle	1000 years
Glass bottle	Over a million years

9. Nurdle Hunt

'Nurdle Hunt' enables children to learn about plastics in the environment. Through close exploration of the sand and small stones on the beach, children try to identify the presence of nurdles – tiny pieces of plastic that are used in the manufacture of most plastic products. The children will observe the variety in the small stones and particles of sand, and then investigate how they can separate any nurdles from them.

Learning outcomes

CONCEPTUAL UNDERSTANDING IN SCIENCE

The children will develop ideas about:

- ☑ The composition of sand and fine shingle;
- ☑ Similarities and differences between sand from different parts of the beach;
- ☑ Nurdles – how to identify them, what they are and where they have come from;
- ☑ The impact of nurdles on the natural environment.

KEY VOCABULARY

sand
stones
shingle
shell
fine-grained
coarse-grained
fragment
manufactured
natural
biodegradable
non-biodegradable
currents
tide
waves
wind
pollution
decompose
nurdle
microplastic

WORKING SCIENTIFICALLY

Investigation types – this activity provides opportunities for:

- Identifying, grouping and classifying investigation
- Research

Key skills the children might learn and apply:

- Asking questions
- Observing
- Recording data

Checklist: before you go to the beach

HEALTH AND SAFETY

- ☑ Carry out a full risk assessment.
- ☑ Check the tide times – going on a falling tide near low water is best, both for safety and to ensure that different areas of the beach are exposed and can be explored.
- ☑ Check that there are nurdles on the beach that you will be visiting.
- ☑ Ensure that children wear gloves to touch nurdles.
- ☑ Make sure that children are aware of The Seashore Code.

PRIOR DISCUSSION WITH THE CHILDREN

To get the most out of the activities at the beach, it is helpful if the children have had the opportunity to discuss their ideas about:

- What sand is and where it comes from
- The terms 'manufactured' and 'natural' and how to identify and classify items as such
- Nurdles – what they are, where they come from and how they might end up on the beach
- Why nurdles are a threat to the natural environment
- How to identify the presence of nurdles in sand or fine shingle

WHAT YOU NEED IN YOUR RESOURCE BUCKET

Essential:

- White trays or tubs
- Scoops or spoons
- Tweezers
- Disposable gloves
- Selection of sieves with different-sized holes in the mesh
- Hand lenses
- Paper and pencils

Optional:

- Camera

At the beach

WHAT TO DO

- Give the children boundaries for an area in which to look and encourage them to collect a sample of sand or fine shingle in their trays, using a scoop or spoon.
- Prompt the children to look carefully at their sample, taking note of the composition of it and the variety of things within it – they might notice grains of sand of different sizes and colours, small stones of different shapes, sizes and colours, a range of different types of shell and fragments of shells, and other materials such as pieces of plastic, including nurdles.
- Encourage the children to use hand lenses to explore more closely.
- Ask the children to compare their observations with those of another child or group.
- Prompt the children to collect a second sample from a different part of the beach and compare this with their original sample, and to suggest reasons for any differences that they find.
- Discuss with the children how they could separate their samples into fine-grained and coarse-grained sand or shingle.
- Provide the children with a selection of sieves and encourage them to separate their samples. NB they should wear gloves if they are going to touch the samples containing nurdles.
- Observe and discuss what happens to the nurdles (or other plastic pieces) when they use sieves to separate their samples and ask them how they might be able to separate out the nurdles completely.
- If needed, prompt the children to cover their sample in sea water and watch what happens to the different components. Generally, nurdles should float and the rest of the sample should sink, which should make it easier to separate them off. Observe the separated nurdles closely.
- Ask the children to consider the impact of nurdles on living things in the sea and on the beach.
- Discuss what they should do with the nurdles that they have separated from their samples.
- Tell the children that they should put back the sand/shingle samples but collect all the nurdles to take back to school to dispose of in a plastic recycling facility.
- It might be helpful to take photographs of the locations on the seashore where nurdles were found to use as a prompt back in the classroom.

KEY QUESTIONS

- What can you see in your sand/shingle sample? What different shapes and sizes of sand grains and small stones can you see? What different colours can you see?
- What shells have you found? Are any of them whole? Have you found any fragments of shells? Why do you think that they have broken up into fragments?
- Have you found any nurdles? What do they look like?
- How could you separate your sample into fine grains and coarse grains?
- How could you separate out the nurdles from the sand/shingle?
- Do you think nurdles will float or sink? Why do you think that? How might this help to separate them from the sand/shingle?
- What problems might the nurdles cause for living things?
- How long do you think that these nurdles have been in the sea? Why do you think that? Where might they have come from? How long do you think they will take to decompose/biodegrade?
- What do you think we should do with the nurdles now that we have separated them?

Nurdles washed up on a beach

Back in the classroom

EXTENDING LEARNING

- Create a beach 'map' to show where nurdles were found, using any photographs taken as prompts.
- Discuss why nurdles might have been found in particular places on the beach, relating this to other features on the beach.
- Discuss further questions that they have about nurdles and how they could research these, e.g.
  - Do all nurdles float?
  - What might make them decompose or biodegrade?
  - How do nurdles end up in the ocean and on the beach?
  - What impact do nurdles have on living things?
  - How can we clean up the beaches and the ocean to remove nurdles?
  - How can we prevent more nurdles entering the ocean?
- Draw diagrams to show how nurdles, or toxic waste carried by them, enter the food chain and how this means that humans can end up eating them.
- Share with the children how the nurdles will be disposed of.

FURTHER RESOURCES RELATED TO 'NURDLE HUNT'

Primary science teaching trust resources

- **Science Fun at Home**
  - Scavenger Science
- **I bet you didn't know**
  - Plastics in soil

Explorify activities

- **Have you ever .... seen rubbish where it shouldn't be?**
- **What if .... there was no plastic?**
- **Glorious grains**
- **Sandy adventurers**
- **Wet, wet, wet**
- **Synthetic selection**

Background science for teachers

Nurdles are small, lentil-sized plastic pellets that are used as a raw material in the production of plastic products. They are also known as 'pre-production plastic pellets' or 'microplastic pellets'. Nurdles can escape during transportation, storage and handling, and end up in the environment. They are transported by ocean currents and wind and are therefore a significant source of plastic pollution in oceans and on beaches.

Nurdles have been found on many UK beaches, particularly those close to industrial areas, shipping lanes, or plastic manufacturing facilities. Additionally, nurdles have been known to wash up on beaches after cargo ships have lost containers at sea. However, not all beaches in the UK will have nurdles present, and efforts to clean up and prevent plastic pollution can help reduce their presence on beaches.

Nurdles are a major concern for the health of marine ecosystems and human health as well.

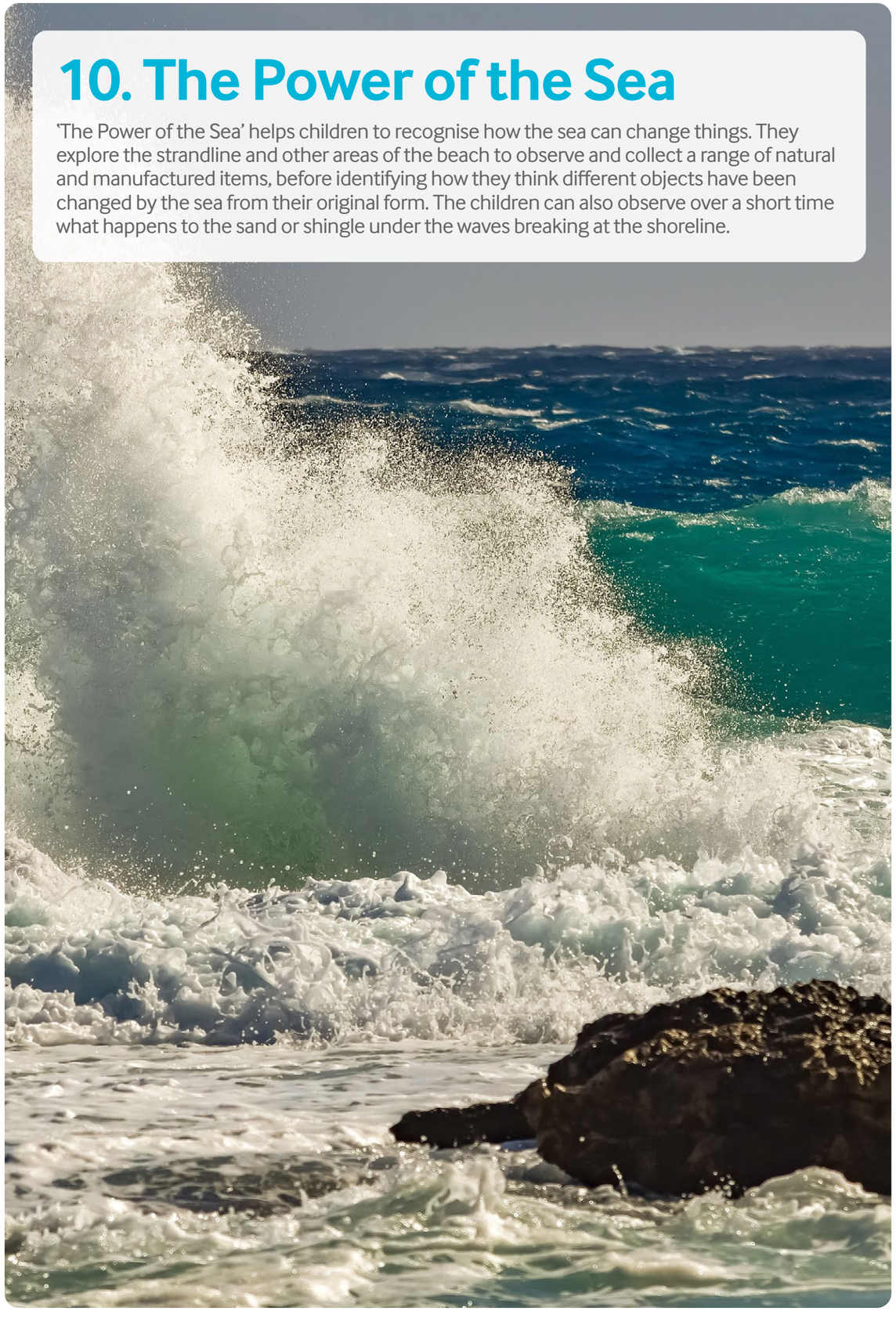
They can damage living things in several ways. When they are mistaken for food by marine animals, they can cause physical harm by blocking their digestive tracts and preventing them from properly absorbing nutrients. This can lead to starvation and even death. Nurdles can also release toxic chemicals into the environment, which can harm marine life and other organisms that come into contact with them. They often act as 'rafts' for harmful bacteria, for example by transporting them from sewage outfalls to shellfish cultivating beds and to places where people might be bathing.

Nurdles also have indirect impacts on ecosystems. They can absorb and concentrate harmful chemicals from their surrounding environment, which can then be transferred up the food chain as larger organisms consume the nurdles. This can lead to the accumulation of toxic substances in the bodies of top predators, including humans who consume seafood.

In addition, nurdles contribute to the larger issue of plastic pollution in the environment. As they break down into smaller particles, they can become microplastics which are difficult to remove from the environment and can persist for decades or even centuries. Microplastics have been found in many marine species, and there is growing concern about the potential health impacts of these particles on both wildlife and humans.

10. The Power of the Sea

'The Power of the Sea' helps children to recognise how the sea can change things. They explore the strandline and other areas of the beach to observe and collect a range of natural and manufactured items, before identifying how they think different objects have been changed by the sea from their original form. The children can also observe over a short time what happens to the sand or shingle under the waves breaking at the shoreline.



Learning outcomes

CONCEPTUAL UNDERSTANDING IN SCIENCE

The children will develop ideas about:

- ☑ Movement of the sea, including waves and tides;
- ☑ How materials change over time, and how these changes relate to the length of time that the material has been in the sea;
- ☑ Erosion and the formation of pebbles, shingle and sand.

KEY VOCABULARY

sea
waves
tide
current
wind
rock
natural
manufactured
change
weathering
friction
erosion

WORKING SCIENTIFICALLY

Investigation types – this activity provides opportunities for:

- Pattern seeking
- Identifying, grouping and classifying

Key skills the children might learn and apply:

- Asking questions
- Observing
- Recording data

Checklist: before you go to the beach

HEALTH AND SAFETY

- ☑ Carry out a full risk assessment.
- ☑ Check the tide times – going on a falling tide near low water is best, both for safety and to ensure that a good length of the shoreline can be explored.
- ☑ Make sure that children are aware of The Seashore Code.

PRIOR DISCUSSION WITH THE CHILDREN

To get the most out of the activities at the beach, it is helpful if the children have had the opportunity to discuss their ideas about:

- What objects they expect to find on the beach and along the shoreline. These might include natural non-living objects such as sand, shingle, small pebbles, rocks, shells, shell fragments, sea glass, other evidence of animal life, manufactured objects such as plastic waste, pieces of metal, and living things such as animals in rock pools, seaweed, marine and land plants;
- How these objects started out, how they might have changed, and what might have brought about the changes;
- The movement of the sea, including tides and waves;
- The effect of wind on the sea;
- Erosion and what happens when rocks continually bash against each other.

WHAT YOU NEED IN YOUR RESOURCE BUCKET

Essential:

- Trays or tubs
- Hand lenses
- Paper and pencils

Optional:

- Camera

At the beach

WHAT TO DO

- Give the children boundaries for an area along the strandline in which to look and encourage them to go and find just one object that they think is really interesting.
- Working in groups, prompt the children to show their item to the others and explain why they find it interesting and to say if they think it has been in the sea for a short time or a long time and why they think this.
- Ask the children to identify what they think their object is made from, if it is natural or manufactured, and if it has ever been alive.
- Prompt the children to make links between the material their object is made from, its shape and how long they think it has been in the sea.
- Ask the children to go back to the strandline and find two further objects: one that they think has been in the sea for a short time, and another that they think has been in the sea a lot longer. Encourage them to share what they have found with their group.
- Ask the children to put some of their objects in their tray or bucket, cover them with sea water and then agitate the bucket to observe what happens to the objects.
- Encourage the children to make predictions about what they think will happen to their object over time, including how its shape might change, or if it might decompose.
- Prompt the children to stand by the shoreline and observe the waves breaking onto the shore, looking in particular at the sand/shingle under the breaking waves and observe how this moves each time a new wave breaks.
- Ask them to focus their attention on one particular stone under the waves and encourage them to 'track' its movement during the time it takes for ten waves to break. If there are no stones that stand out enough to do this, they could find a distinctive stone from another area of the beach and drop it into the water.
- It might be helpful to take photographs of objects found in different locations on the seashore to use as a prompt back in the classroom.

KEY QUESTIONS

- What object have you found that you think is really interesting? Why do you think that it is so interesting?
- What material is your object made from? Is it natural or manufactured? Has it ever been alive?
- What shape is your object? Why do you think it is that shape? Has it always been that shape or has it changed?
- How long do you think that your object has been in the sea? Why do you think this?
- Can you find an object that has only just gone into the sea? What about another object that you think has been in the sea for a long time?
- What happens to the sand/shingle at the shoreline where the waves are breaking? How does it move? Can you track a stone to see where it starts and ends after ten waves have broken?
- How do you think sand forms?

Sea glass: broken fragments of glass that have been smoothed by the sea over time.

Back in the classroom

EXTENDING LEARNING

- Use the photographs taken of different objects to create a display onto which children can write and/or draw around the images to show what the object is and how it has changed by being in the sea.
- Ask the children to draw a timeline for one of their objects – what it looked like to start with, what it looked like when it first ended up in the sea, what it looks like now, and what they think it will look like in the future when it has been in the sea for more time.
- Find out more about how glass is made, and how it can end up in the sea.
- Compare and contrast pebbles found on the beach with stones found in and around the school grounds, focusing particularly on their shapes.
- Find out more about wave power as a sustainable energy source.

FURTHER RESOURCES RELATED TO 'THE POWER OF THE SEA'

Primary science teaching trust resources

- **Bringing Back Glass** - A set of practical activities to help children explore the use of glass in everyday life
- **The Big Jurassic Classroom** - resources to support the teaching of rocks, fossils and evolution

Explorify activities

- **Have you ever... picked up a rock you found and put it in your pocket to take home?**
- **Who is... Mary Anning?**
- **Sandcastle**
- **Glorious grains**

Background science for teachers

The constant movement of sea water can cause erosion of rocks. Stones and pebbles are formed from larger pieces of rock. Over time these rocks are eroded by wind, water and the Sun. Erosion by the sea can happen in a variety of ways:

Abrasion – waves and currents can carry rocks and sediment that scratch, scour, or chip away at the surface of the rock. This process often creates smooth, rounded shapes.

Hydraulic action – the force of the water crashing against the rock can create cracks or crevices. As the water continues to pound against them, these cracks can become larger over time and eventually split.

Corrosion – the seawater can react chemically with minerals in the rock, causing the rock to dissolve and weaken.

Biological weathering – some marine organisms, such as barnacles, clams and mussels, can attach themselves to the rock and secrete substances that weaken the rock by dissolving some of the minerals in them.

As the rocks break apart into smaller rocks, the process continues with the pieces becoming smaller and smaller. The movement of the sea and the tumbling of small rocks against other small rocks causes them to be smoothed down until they finally become what we call stones and pebbles. These continue wearing away, becoming smaller and smaller, eventually forming grains of sand. Sand is made up of very small, loose pieces of rock and minerals. Sand may also contain the remains of living things such as shells.

The sea can have different effects on different materials. For example:

Metals – the sea can cause metals to corrode or rust due to the saltwater and exposure to air. This can weaken the metal and make it more brittle over time, causing metal objects to break apart.

Wood – the sea can cause wood to swell, warp or rot due to exposure to moisture. Saltwater can also cause wood to become more susceptible to insects and fungi.

Plastics – some types of plastics can become brittle or crack when exposed to the sun and saltwater, while others may degrade over time due to UV exposure. Most plastics however do not decompose easily.

Fabrics – saltwater can cause fabrics to fade and can also weaken the fibres over time.

Glass – this can become etched or frosted by saltwater and sand and may also be scratched or cracked by rocks and other debris in the water.

The strandline, also called the tideline, is the line or mark left on a beach by the highest point of the tide. It is often seen as a distinct area or band where items have been carried up the beach and deposited by the tide at high water. This debris is then left behind when the tide goes out again. Many items that are washed up by the sea can be found along the strandline.

11. Wet, Wet, Wet

'Wet, Wet, Wet' encourages the children to search for places around the beach where there is water when the tide has gone out, and to think about why the water is still there and what will happen to it.

Learning outcomes

CONCEPTUAL UNDERSTANDING IN SCIENCE

The children will develop ideas about:

- ☑ Why water remains in particular places on the beach when the tide has gone out;
- ☑ How water can drain through sand and soil;
- ☑ Changes of state, evaporation and the water cycle;
- ☑ How the weather can affect life on the seashore.

KEY VOCABULARY

water
tide
flow
rocks
rock pool
permeable
porous
water table
gravity
solid
liquid
gas
evaporation

WORKING SCIENTIFICALLY

Investigation types – this activity provides opportunities for:

- Comparative testing
- Pattern seeking

Key skills the children might learn and apply:

- Asking questions
- Observing
- Making predictions
- Interpreting and communicating results

Checklist: before you go to the beach

HEALTH AND SAFETY

- ☑ Carry out a full risk assessment.
- ☑ Check the tide times – this visit needs to be carried out on a falling tide close to low water, both for safety and to ensure that there is plenty of beach that can be explored.
- ☑ Make sure that children are aware of The Seashore Code.

PRIOR DISCUSSION WITH THE CHILDREN

To get the most out of the activities at the beach, it is helpful if the children have had the opportunity to discuss their ideas about:

- Tides – what is meant by high water and low water, and how long the tide takes to go out and come in;
- Tides being caused by the gravitational pull of the Moon and the Sun, and that the heights of high and low tides fluctuate, following a predictable pattern, according to the position of the Moon relative to the Sun;
- Solids, liquids, gases, changes of state and, in particular evaporation and the water cycle;
- What happens to the water in streams and rivers, and how sometimes this can flow out onto a beach.

WHAT YOU NEED IN YOUR RESOURCE BUCKET

Essential:

- Small spades (or other tools to dig with, or the children can use their hands)

Optional:

- Camera
- Small containers for taking sand/shingle/pebble samples back to school

At the beach

WHAT TO DO

- Give the children boundaries for an area in which to look and encourage them to walk around the beach looking for where they can see water.
- Ask the children if they can spot where the most recent high water line is and to explain how they identified this. Then ask them to see if they can spot where the highest water line on the beach might be and how they identified this.
- Prompt the children to observe and describe what differences they notice between the sand/shingle/pebbles above and below the strandline, including how wet they are.
- Where the children have found water, ask them where they think it has come from: water below the strandline is likely to have been left there since the last high tide, and water above the strandline is most likely to have come from a stream or river flowing onto the beach, or from previous rain.
- Tell the children that they are going to dig small holes in different parts of the beach. Ask them to predict what they will observe when they dig a hole, and the differences they might observe between holes dug above and below the strandline, and at different points between the strandline and lower down the beach.
- Prompt the children to dig the holes and observe carefully. Before the l eave the beach they should fill these in again.
- Discuss what might happen to the water on a sunny and windy day compared with a still and cloudy day.
- Prompt them to think about the effects of water evaporating from rock pools on the animals and plants that live there.
- It might be helpful to take photographs of the holes that the children have dug to use as a prompt back in the classroom. For follow up work to compare sand/shingle/pebbles with soil, take small samples of sand/shingle/pebbles from above and below the strandline back to school.

KEY QUESTIONS

- Where can you see water on the beach? How do you think it got there?
- Can you identify where the last high tide was? How did you decide?
- What do you notice about the sand and pebbles above the strandline/tideline compared with the sand and pebbles below it?
- How much water is in the sand/shingle above and below the strandline? Why is this?
- Do you think it is that there is any water on the beach that isn't seawater? What else could it be? How would it have got there?
- What do you think that you will see when you dig a small hole in the sand/shingle above the strandline? What about below the strandline? What differences might you notice?
- What differences might you notice as you dig small holes further down the beach, closer to where it will be low tide?
- Why do the holes below the strandline fill with water? Why do the holes fill up with more water as you get nearer the sea? What will happen to the holes when the tide comes in?
- What do you think will happen to the water on the beach on a sunny and windy day? How will this affect the living things in the rock pools?

Learning at the beach can support understanding of the importance of the sea in the water cycle

Back in the classroom

EXTENDING LEARNING

- Investigate how long it takes for water to drain through the samples of sand/shingle/pebbles.
- Compare how long it takes water to drain through sand with how long it takes to drain through different types of soil.
- Find out more about the water table. Use information from this research to explain what they observed when they dug holes in different parts of the beach.
- Explore evaporation. Investigate how the shape of the container affects the rate of evaporation by putting identical volumes of water in different-shaped containers and observing what happens when they are left in the same place over several days. Alternatively, investigate how the location of the container affects the rate of evaporation by putting identical volumes of water in identical containers and observing what happens when they are left in different locations (warm, cool, draughty, etc.). Relate what they find to rock pools and how evaporation will affect the living things in them. Use the findings from their investigation to offer explanations about why water might evaporate more quickly from some rock pools than others.
- Give the children printed copies of the photographs of the holes that they dug at the beach and ask them to write or draw around them to describe where on the beach the hole was dug and how they know this.
- Make a wall display that is a 'map' of the beach on which the children can write, draw and stick on pictures to record what they have learned about water on the beach.

FURTHER RESOURCES RELATED TO 'WET, WET, WET'

Primary science teaching trust resources

- **Science Fun at Home** - Salty Science, Watery Science
- **The Big Jurassic Classroom** - resources to support the teaching of rocks, fossils and evolution
- **I bet you didn't know** - It's raining all over the world – extreme weather connections

Explorify activities

- **Have you ever ... splashed in a puddle?**
- **Tiny grains**
- **Glorious grains**
- **What if water didn't evaporate?**

Background science for teachers

The strandline, also called the tideline, is the line or mark left on a beach by the highest point of the tide. It is often seen as a distinct area or band where items have been carried up the beach and deposited by the tide at high water. This debris is then left behind when the tide goes out again.

The water table is the level below the Earth's surface where water is found in the ground. It is the top layer of saturated soil, rock or sand, where the spaces between the particles are filled with water. The water table can be thought of as an underground lake or river.

The water table at the beach is influenced by the proximity to the ocean, as well as by the level of the tides. During high tide, the water level in the ocean rises and the groundwater near the beach can also rise. This can lead to a situation where the water table is very close to the surface, resulting in wet sand or even standing water in some areas of the beach. This means that, when small holes are dug in the sand, those below the strandline will fill with water whereas those above the strandline are less likely to do so. During low tide, the water table can recede and be deeper underground, but small holes below the strandline can still fill with water.

The water table at the beach is an important factor to consider for coastal engineering and construction projects, as it can affect the stability of structures such as buildings, boardwalks, and seawalls. It can also impact the quality of the water in the ocean and the nearby freshwater resources, such as streams and rivers, can flow into the ocean, bringing pollutants or nutrients with them.

At the beach, water can evaporate from the surface of the ocean, lakes, rivers, or other bodies of water, as well as from the surface of wet sand or other moist surfaces. The rate of evaporation from the beach depends on several factors, including the temperature, humidity, wind speed, and the surface area of water or wet sand exposed to the air. Higher temperatures, lower humidity, and stronger winds can all increase the rate of evaporation.

As water evaporates from rock pools, it can increase the concentration of salt in the water remaining in the rock pool, because the salt is left behind when the water evaporates. This can create a harsher environment for the living things in the rock pools. On a hot and/or windy day, or if the rock pool is small and/or shallow, the water may evaporate completely, threatening the survival of the living things in the rock pool. Evaporation of water from the beach also plays a role in the water cycle. When water evaporates from the beach, it becomes water vapour, which can then condense to form clouds and precipitation in other areas.

12. Salty Situation

'Salty Situation' gives children the opportunity to explore rates of evaporation, observe what remains when the water evaporates from seawater, and consider the role of evaporation in the water cycle.

Learning outcomes

CONCEPTUAL UNDERSTANDING IN SCIENCE

The children will develop ideas about:

- Changes of state, evaporation and the water cycle;
- Factors that affect the rate of evaporation of water;
- Dissolving and how a solid can be recovered through evaporating water from the solution;
- Where evaporation occurs on the beach, and the conditions that affect the rate of evaporation.

KEY VOCABULARY

solid
liquid
gas
change of state
evaporation
condensation
precipitation
water cycle
water vapour
humidity
wind
warmth
temperature
surface
dissolving
rock pool
tide

WORKING SCIENTIFICALLY

Investigation types – this activity provides opportunities for:

- Comparative testing
- Pattern seeking
- Problem solving

Key skills the children might learn and apply:

- Asking questions
- Observing
- Making predictions
- Interpreting and communicating results

Checklist: before you go to the beach

HEALTH AND SAFETY

- Carry out a full risk assessment.
- Check the tide times – going on a falling tide near low water is best, both for safety and to ensure that rock pools are exposed.
- Make sure that children are aware of The Seashore Code.

PRIOR DISCUSSION WITH THE CHILDREN

To get the most out of the activities at the beach, it is helpful if the children have had the opportunity to discuss their ideas about:

- Solids, liquids, gases, changes of state and, in particular, evaporation and the water cycle;
- How wet materials and objects 'dry out' and the factors that affect how fast this happens;
- The sea being salty – where the salt comes from, how it is dissolved in the water but is not visible, how we can tell that it is there (taste, floating more easily).

WHAT YOU NEED IN YOUR RESOURCE BUCKET

Essential:

- Small pots with lids in which to carry water

Optional:

- Camera

At the beach

WHAT TO DO

- Give the children boundaries for an area in which to look and encourage them to identify and observe different dry areas and wet areas.
- Ask them to describe the wet and dry areas and the features of each that they have noticed.
- Encourage the children to collect a range of objects from the beach.
- Working in groups, prompt them to sort their collection into wet and dry objects and to discuss similarities and differences within each group, focusing on observable features of the object, e.g. whether it is natural or manufactured, the that material it is made from, as well as where on the beach they found it.
- Prompt the children to place the objects in the 'wet' group in an order along the sand, from the one that they think will dry out the most quickly to the one that they think will take the longest time to dry out.
- Ask them to give reasons for their choice of order and encourage them to look at what other groups have done and to ask questions about why they made their choices.
- Tell the children that they will be investigating sea water back in the classroom and prompt them to collect samples from rock pools or other areas of the beach with standing sea water in them.
- It might be helpful to take photographs of the groups of dry and wet objects found in different locations on the seashore to use as a prompt back in the classroom.

KEY QUESTIONS

- Why do you think some parts of the beach are dry and others are wet?
- Are the dry parts of the beach always dry? What might make them wet? What would make them dry out again?
- What objects have you found that are wet? Do they have anything in common? What are they made from? Where did you find them?
- What objects have you found that are dry? Do they have anything in common? What are they made from? Where did you find them?
- Did you find anything wet in a dry area? Or dry in a wet area? Why do you think this is?
- Which of your wet objects do you think will dry out the most quickly? Which will take the longest time to dry out? Why do you think this?
- What makes the beach or the objects dry out? Where does the water go?
- Do you think that water will evaporate from rock pools? Why do you think this? What about from the sea?

Back in the classroom

EXTENDING LEARNING

- Where in the classroom/school do you think the water will evaporate the most quickly? Why do you think this?
- What difference do you think the shape of the container makes to the rate of evaporation?
- What do you notice about the salt crystals from the sea water? How do these compare with the salt crystals recovered from the salt solutions made from fresh water?
- Investigating evaporation of water from salty water.

1. Using the sea water samples collected, investigate how the shape of the container affects the rate of evaporation by putting identical volumes of sea water in different-shaped containers (from narrow and deep to wide and shallow) and observing what happens when they are left in the same place over several days.
2. Alternatively, investigate how the location of the container affects the rate of evaporation by putting identical volumes of water in identical containers and observing what happens when they are left in different locations (warm, cool, draughty etc.).
3. Use the findings from their investigations to offer explanations about why water might evaporate more quickly from some rock pools than others.
4. Observe the solids left behind when the water has evaporated from the sea water samples. These will mostly be salt. Use hand lenses to look closely at the salt crystals, noticing their shape, size and arrangement in the bottom of the container.
5. Compare the salt crystals left behind from evaporation of water from a sea water sample with the crystals left behind in a salt solution made with fresh water. Further comparisons can be made with different concentrations of salt dissolved in fresh water.

- Find out more about where the salt in the sea comes from and why some seas around the world are saltier than others.
- Find out more about the process of obtaining salt from the sea for cooking purposes.
- Research the water cycle and the role of evaporation of water from the surface of the sea.

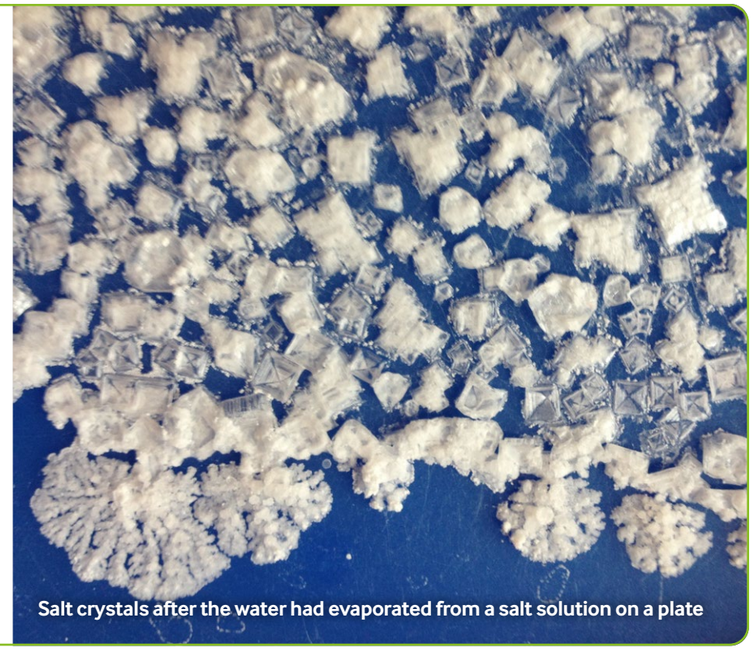
FURTHER RESOURCES RELATED TO 'SALTY SITUATION'

Primary science teaching trust resources

- **Science Fun at Home**
  - Salty Science, Watery Science
- **I bet you didn't know**
  - Water harvesting

Explorify activities

- **Have you ever ... tasted sugar in your cereal milk?**
- **Have you ever ... needed to dry something quickly?**
- **Rock star**
- **Are all salt crystals the same shape?**
- **What if water didn't evaporate?**



Salt crystals after the water had evaporated from a salt solution on a plate

Background science for teachers

Evaporation is a process by which a liquid becomes a gas. When water evaporates it becomes water vapour (or steam), which is the gaseous form of water and is invisible. Evaporation happens when the water molecules at the surface of the liquid gain enough energy to escape from the liquid and become a gas. The surface molecules gain energy when the liquid is warmed or heated. The water vapour rises into the air above the liquid and when it meets cooler air at higher altitudes, it condenses back into a liquid, forming tiny droplets of water suspended in the atmosphere. These droplets are visible as clouds.

Boiling is also a process by which a liquid becomes a gas, but unlike evaporation, it happens throughout the entire liquid and not just at the surface. Boiling within the liquid results in bubbles of gas forming that rise to the surface and escape into the air above. Boiling happens when the liquid is heated to its boiling point, whereas evaporation can happen at temperatures below this.

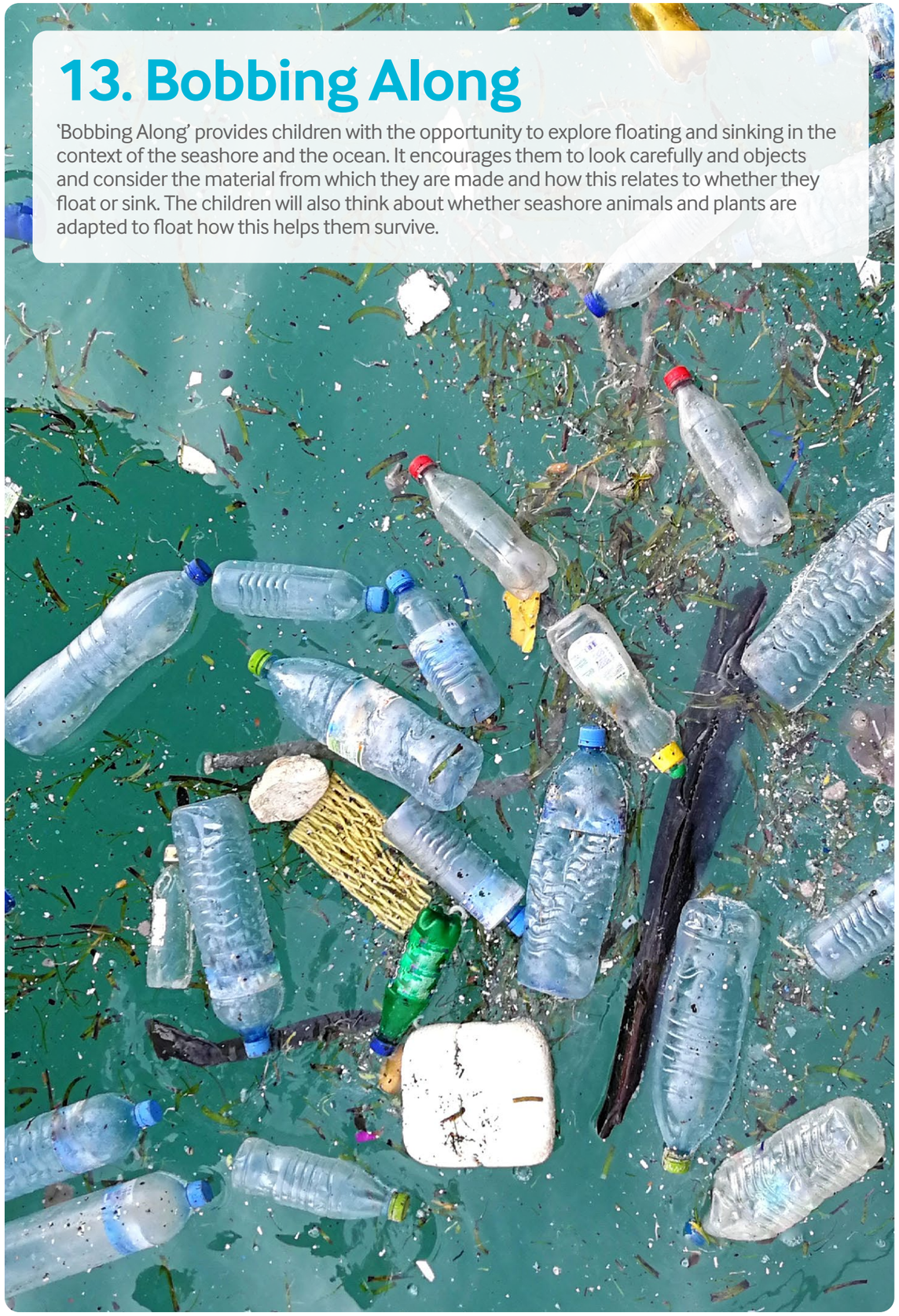
Evaporation can happen anywhere there is water, provided there is enough warmth. The warmer the surrounding temperature the faster the rate of evaporation which is why a puddle dries up more quickly outside on a sunny day than it does on a cloudy day. As the water evaporates from a puddle, the concentration of water vapour in the air above the puddle increases. If the air becomes saturated with water vapour, this will slow down the rate of evaporation of the rest of the puddle. When it is windy, the air above the surface of the puddle will be moved by the wind, taking away the water vapour with it. This is why on a windy day a puddle will evaporate more quickly than on a still day. Because evaporation happens at the surface, a particular volume of water will evaporate more quickly from a wide, shallow dish than it will from a narrow, deep dish because the water in the wide shallow dish will have a greater surface area in contact with the air above it.

Evaporation happens all around us, even when we don't see it. For example, when you breathe out on a cold day and you see your breath, it is actually water vapour from your breath that has evaporated and then condensed again when it meets the cold air. Evaporation is an important part of the water cycle, and evaporation from the oceans is vital for the production of fresh water.

Evaporation from salty water works the same way as evaporation from fresh water, but there is one important difference. When water evaporates from salty water, the salt is left behind, so the water that is left behind becomes even saltier. The sea salt that we use in cooking is produced by leaving salt water from the ocean to evaporate in shallow pools. As the water evaporates, the salt is left behind and can be collected and processed into table salt.

13. Bobbing Along

'Bobbing Along' provides children with the opportunity to explore floating and sinking in the context of the seashore and the ocean. It encourages them to look carefully and objects and consider the material from which they are made and how this relates to whether they float or sink. The children will also think about whether seashore animals and plants are adapted to float how this helps them survive.



Learning outcomes

CONCEPTUAL UNDERSTANDING IN SCIENCE

The children will develop ideas about:

- ☑ Why some objects float and others sink;
- ☑ The material an object is made from and how this is related to whether it will float or sink;
- ☑ How changing the shape of an object can make it float/sink;
- ☑ Objects that are washed up onto the beach and why they are likely to be able to float;
- ☑ Adaptations of living things that give them buoyancy;
- ☑ Objects floating more easily in salty water than in fresh water.

KEY VOCABULARY

float
sink
material
buoyancy
force
resistance
gravity
upthrust
salt
adaptation

WORKING SCIENTIFICALLY

Investigation types – this activity provides opportunities for:

- Comparative testing
- Identifying, grouping and classifying
- Problem solving

Key skills the children might learn and apply:

- Asking questions
- Observing
- Making predictions
- Setting up tests

Checklist: before you go to the beach

HEALTH AND SAFETY

- ☑ Carry out a full risk assessment.
- ☑ Check the tide times – going on a falling tide near low water is best, both for safety and to ensure that rock pools and sand pools are exposed.
- ☑ Make sure that children are aware of The Seashore Code.

PRIOR DISCUSSION WITH THE CHILDREN

To get the most out of the activities at the beach, it is helpful if the children have had the opportunity to discuss their ideas about:

- Floating and sinking and why they think that some objects float and other objects sink;
- Objects that they might find washed up on the beach and whether these are likely to float or sink;
- What it feels like swimming in the sea compared with in a swimming pool;
- Why it might be useful for marine plants and animals to be able to float.

WHAT YOU NEED IN YOUR RESOURCE BUCKET

Essential:

- Collecting bags or trays
- Small buckets

Optional:

- Camera

At the beach

WHAT TO DO

- Give the children boundaries for an area along the strandline in which to look and encourage them to find a collection of objects that they find interesting, e.g. wood/metal/plastic items that have been washed up on the beach, pieces of seaweed, shells, small rocks or pebbles.
- Working in threes or fours, prompt the children to sort their objects into two groups according to whether they think the objects will float or sink.
- Ask the children to make sure that they agree, and can justify their reasons for their choices.
- Mix the children up and ask them to look at how other children sorted their objects to see if they agree.
- Tell the children that they are going to test their predictions about all the objects in a rock pool, sand pool, or bucket of water.
- Once the children have tested all their objects, ask them to describe what they observed and if they were surprised by anything. Ask them to sort them into new groups according to whether they actually floated or sank.
- Ask the children to think about what all the objects that floated had in common, and what all the objects that sank had in common, focusing on the material that the objects are made from.
- Prompt the children to consider whether the objects are a natural part of the beach (e.g. pebbles, small rocks, seaweed) or whether they have been washed up from the ocean (e.g. plastic/wood/metal items) and to consider whether there is a link between their origins and whether they float or sink.
- Prompt the children to think about, and then test, what they could do to a sinking object that might make it float.
- Ask the children why some animals and plants at the seashore have adaptations that help them, or part of them, float or partially float.
- Challenge them to find some seaweed with air bladders and to observe it closely, and discuss the advantage that the air bladders give the seaweed.

KEY QUESTIONS

- What objects have you found? Do you think that they will float or sink? Why do you think this?
- What do you notice about your groups of objects? What do the objects that you think will float have in common? What about the objects that you think will sink?
- What materials are your objects made from? How do you think this affects whether they will float or sink?
- What did you notice when you tested your objects? Did anything surprise you? Are any of the objects now in a different group?
- Which of your objects are a natural part of the beach and which have been washed up from the ocean? Is there any correlation between where they have come from and whether they float or sink?
- Are there any of you objects that sank that you think you could make float? How could you do this?
- Why do you think that it helps some seaweed to have air bladders? How do they work?

Back in the classroom

EXTENDING LEARNING

- Investigate floating and sinking using a washing-up bowl of water. Test a range of items, making predictions beforehand about whether they will float or sink and why.
- Set a challenge to make a sinking object float, or a floating object sink.
- Make boats or rafts out of recycled materials or foil and test how much they can carry before they sink.
- Use a small plastic container with an airtight lid (an old film canister is ideal). Start with it empty and observe that it floats. Using a collection of identical small objects such as paper clips or one penny pieces, add one at a time to the container, testing with each new addition whether it still floats. Try this again, this time using water that has salt dissolved in it to mimic the sea water. Is there a difference in how many of the objects that the container will hold before it sinks compared with fresh water? What if more salt is added to the water? Ask the children to relate their findings to cargo ships at sea and how much cargo they can carry.
- Half-fill a tall see-through container with a strong salt solution. Carefully top up the container with fresh water by pouring it slowly down the inside, trying to avoid the fresh water mixing too much with the salty water. Allow to settle and then gently lower an egg into the container and watch it become suspended in the middle of the container. It will be floating in the salt solution and sinking in the fresh water, hence it appears to be floating in the middle. The children can test whether eggs float in fresh water and in salty water to help them explain what might be happening.
- To show that there are two 'layers' in the container of water, a few drops of food colouring can be added to the salty water. Over time, the two layers will eventually mix together and become a uniform colour and with the same concentration of salt throughout.

FURTHER RESOURCES RELATED TO 'BOBBING ALONG'

Primary science teaching trust resources

- Science Fun at Home - Sink or Swim, Salty Science, Watery Science, World Oceans Day
- Starters for Science - Floating Boats

Explorify activities

- Have you ever ... tried to push a floating toy down under the water?
- Fun Floating
- Dancing raisins
- Funky junky boats

Background science for teachers

Whether an object floats or sinks depends on its density. This is a measure of how much mass (stuff) there is in a particular volume. Something like iron has a high density as even a small piece of it will have a relatively large mass – it is heavy for its size. The same sized piece of polystyrene will have a much smaller mass, which means that its density is much lower than that of iron – the polystyrene is light for its size. Anything that has a lower density than water will float in water, and anything with a higher density than water will sink in water. This explains why very small objects that feel light (like a coin) will sink, and huge objects that feel heavy (like a branch of a tree) will float, as it is not the mass of the actual object that counts, it is its density - whether it is light or heavy for its size, compared with the same sized volume of water. Many children will think that the weight of an object alone determines whether it sinks or floats and expect all heavy objects to sink.

When any object is placed in water, gravity pulls it down. If the object floats, this is because the water exerts an upward force called buoyancy (also known as upthrust), which balances the weight of the object (the downward force due to gravity). The size of this upward force will be equal to the weight of the water displaced by the object: the more water that is displaced, the greater the buoyancy force. A piece of polystyrene, which has a low density (light for its size), only needs to displace a small amount of water for the resulting buoyancy force to balance its weight (the downward force due to gravity), so the polystyrene will float. Now imagine the piece of iron which is very dense (heavy for its size). The weight of water that it would need to displace in order to float will be greater than the weight of its own volume, which means that it will sink.

The density of an object can be changed by altering the amount of space (volume) that it takes up, while keeping the mass the same. For example, a ball of modelling clay will sink, but if you change its shape into a boat which takes up more space overall, it will float. Modern ships are made of steel. The air inside weighs very little making the whole object (the ship) less dense than water. This means that it will have displaced a weight of water equal to its own weight before it gets to the point where the whole ship is submerged, meaning that it will float.

The objects found washed up on the beach are likely to be objects that float. Where objects that would normally sink, e.g. bits of metal, wash up on the beach, it is likely that they were originally part of an object that floated and became separated in shallower water.

When salt is added to water, the mass of the solution will increase – the more salt added, the greater the mass. But because the salt is dissolved in the water, there is very little increase in the volume of the solution. This means that the density of the solution increases – it has become heavier for its size. A ship will therefore float slightly higher in salty water than in fresh water, meaning that it can be loaded with more cargo when it is in salty water than in fresh water.

14. Sounds of the Seashore

'Sounds of the Seashore' encourages children to listen carefully to the sounds made at the seashore and think about how they are made, and how we hear them. The children deepen their understanding by creating their own seashore sounds and investigating how these sounds can be changed.

Learning outcomes

CONCEPTUAL UNDERSTANDING IN SCIENCE

The children will develop ideas about:

- ☑ The variety of sounds at the seashore;
- ☑ How they can change the pitch of a sound;
- ☑ How they can change the volume of a sound.

KEY VOCABULARY

sound
hear
listen
pitch
higher
lower
volume
louder
quieter

WORKING SCIENTIFICALLY

Investigation types – this activity provides opportunities for:

- Identifying, grouping and classifying investigation
- Pattern seeking
- Research
- Problem solving

Key skills the children might learn and apply:

- Asking questions
- Observing and measuring
- Setting up tests

Checklist: before you go to the beach

HEALTH AND SAFETY

- ☑ Carry out a full risk assessment.
- ☑ Check the tide times – going on a falling tide near low water is best, both for safety and to increase the chances of hearing a greater variety of sounds.
- ☑ Make sure that children are aware of The Seashore Code.

PRIOR DISCUSSION WITH THE CHILDREN

To get the most out of the activities at the beach, it is helpful if the children have had the opportunity to discuss their ideas about:

- How sounds are made;
- How we hear sounds;
- Pitch and volume.

It would also be beneficial if they are familiar with creating a sound map so they aren't doing this for the first time at the beach. Any environment where the children will hear a few different sounds would be a good place to practise, e.g. the playground.

CREATING A SOUND MAP

A sound map is a record of the different sounds that the children hear around them. They can be created on paper or card (A4 size at least), and the children can write, draw or both. They should first sit quietly and just focus on the sounds that they can hear. As they identify different sounds, they start to record these on their map. They should imagine themselves at the centre of the paper and then mark each sound on their paper in the position relative to themselves, e.g. if they hear a bird behind them, they would draw this at the bottom of the paper.

The **Sensory Trust** has helpful guidance about creating sound maps

WHAT YOU NEED IN YOUR RESOURCE BUCKET

Essential:

- Small buckets or plastic trays/pots
- Paper and pencils

Optional:

- Camera
- String
- Hand lenses

At the beach

WHAT TO DO

- Invite the children to sit down, close their eyes and listen to the sounds that they hear. Ask them to focus only on the sounds that they can hear around them. Give them plenty of time for this. Remind them that the louder or more obvious sounds might be 'hiding' quieter, less frequently-made or less obvious sounds and encourage them to keep listening for these as well.
- Ask the children to make a sound map by drawing the sounds that they hear around them.
- Encourage the children to discuss their sound maps with a partner or in a small group. Ask them to say what they think was making the sounds.
- Ask the children to make a collection of small objects that they find on the beach, e.g. stones, shells, driftwood. Encourage them to use the objects to make a range of different sounds. Working in pairs, they could ask their partner to close their eyes and see if they can identify the objects that they are using to make a sound.
- Once they have experimented with making different sounds from their collected objects, encourage them to try changing the volume and pitch of their sounds.

KEY QUESTIONS

- What sounds can you hear? Where are they coming from? What might be making them?
- Which sounds have you heard before? Where have you heard them? Have you heard any of them in places that aren't near the sea?
- How can you make sounds with the objects that you have collected? What sort of different sounds can you make? If your partner closes their eyes, can they guess which objects you are using to make a sound?
- Once you have made a sound, can you find a way to change its volume, so make it louder or quieter? How did you do that?
- Once you have made a sound, can you find a way to change its pitch, so make it higher or lower? How did you do that?

Back in the classroom

EXTENDING LEARNING

- Put different items from the beach into lidded pots. Can the children guess the contents by the sounds they make?
- Make a seashore orchestra with items from the beach, or the sound pots above.
- Make a rain-stick using things found on the beach
- Hang different items on string and listen to the vibrations
- Observe what happens to grains of sand on a drum, when the drum is banged first lightly and then more firmly
- Research animals that use echolocation

FURTHER RESOURCES RELATED TO 'SOUNDS OF THE SEASHORE'

Primary science teaching trust resources

- **Science Fun at Home**
  - Sounds of Science, Musical Science
- **Starters for Science**
  - Making music
- **I bet you didn't know**
  - Whale song, Sounds of silence

Explorify activities

- **Bottle orchestra**
- **Rice and rhythm**
- **The sound of silence**
- **Pitch perfect**

Background science for teachers

Sound is a type of energy that travels through the air or other materials. All sounds start with something vibrating (e.g. a knock on the door causes the door and the knocker to vibrate; when someone speaks their vocal cords vibrate) which causes the air molecules around it to vibrate as well. These vibrations are passed on to neighbouring air molecules and in this way, they travel through the air in the form of a sound wave. Sound waves are a way of visualising how sound travels through the air. They spread out in all directions from the source of the sound, like ripples in a pond. When these vibrations reach our ears, they make our eardrums vibrate too which transmits a signal to our brain that then interprets the sound that we are hearing.

Pitch is a way of describing how high or low a sound is. When something vibrates quickly, it creates a high-pitched sound, and when it vibrates more slowly, it creates a low-pitched sound. For example, a bird chirping makes a high-pitched sound, while a dog barking makes a low-pitched sound. Volume refers to how loud or soft a sound is. The more energy the sound waves have, the louder the sound will be so, if for example a drum is banged very hard, the vibrations will be large and the sound wave will have a lot of energy compared with banging a drum gently where the vibrations would be smaller. Sound waves can travel through solid objects, such as a wooden box or table top, and through a liquid, such as the sea as well as through gases like the air around us.

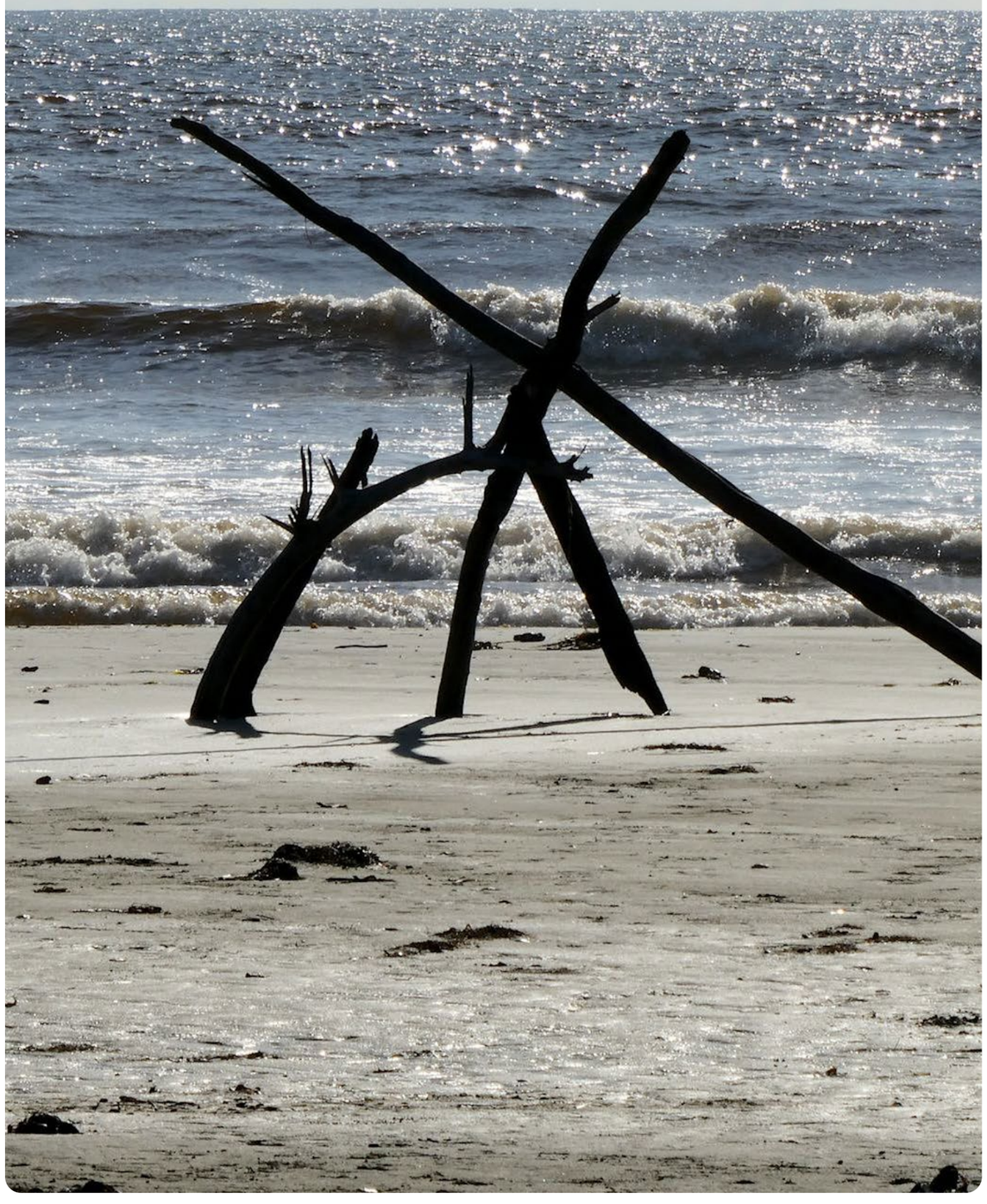
Sound travels much further and faster through water than through air, and many animals communicate underwater using sound. Underwater sound waves are able to travel long distances without losing much of their energy, so animals can use sound to communicate with each other even when they are far apart. Examples of marine animals that communicate using sound include whales, dolphins, porpoises and many species of fish.

These animals use a variety of sounds for communication, such as clicks, whistles, grunts and moans. For example, dolphins use whistles and clicks to communicate with each other, while whales use low-frequency moans and songs to communicate over long distances.

Underwater sound can also be used for echolocation, which is a technique used by many marine mammals, such as whales and dolphins, to locate objects and navigate their environment. They emit a series of clicks and then listen for the echoes that bounce back off nearby objects, allowing them to build up a picture of their surroundings and detect the presence and size of other animals. The echolocation mechanisms of marine animals can be severely disrupted by sound pollution: the use of sonar, marine shipping, and other human activities that use sound to navigate, communicate and hunt.

15. Wave Goodbye

'Wave Goodbye' encourages children to think about the challenges of building stable structures that can withstand external forces. Using materials scavenged from the beach the children create structures and test their stability by replicating the actions of waves.



Learning outcomes

CONCEPTUAL UNDERSTANDING IN SCIENCE

The children will develop ideas about:

- ☑ Common features of stable structures;
- ☑ Suitable foundations for buildings;
- ☑ Forces that buildings need to be able to withstand;
- ☑ The impact of waves on structures on the beach;
- ☑ Erosion and how it causes particular coastal features to develop over time.

KEY VOCABULARY

force
wind
wave
structure
foundation
stable
stability
surface
rock
stone
wood
engineering
natural
manufactured

WORKING SCIENTIFICALLY

Investigation types – this activity provides opportunities for:

- Identifying, grouping and classifying investigation
- Pattern seeking
- Research
- Problem solving

Key skills the children might learn and apply:

- Problem solving
- Comparative and fair testing
- Observation over time

Checklist: before you go to the beach

HEALTH AND SAFETY

- ☑ Carry out a full risk assessment.
- ☑ Check the tide times – going on a falling tide near low water is best, both for safety and to ensure that there is a good stretch of sand on which to build their structures.
- ☑ Make sure that children are aware of The Seashore Code.

PRIOR DISCUSSION WITH THE CHILDREN

To get the most out of the activities at the beach, it is helpful if the children have had the opportunity to discuss their ideas about:

- How buildings stay standing and what makes a strong shape for a building;
- The forces that buildings round the world and in different types of location need to withstand, e.g. wind, earthquake, flooding, waves;
- What types of built structures might be found on and near beaches, and what engineers need to consider when they build them;
- What materials they might find on the beach that they could collect and use to build their own stable structures.

WHAT YOU NEED IN YOUR RESOURCE BUCKET

Essential:

- Buckets or plastic trays
- Empty egg cartons (cut into individual cups), or other small containers

Optional:

- Small spades or spoons

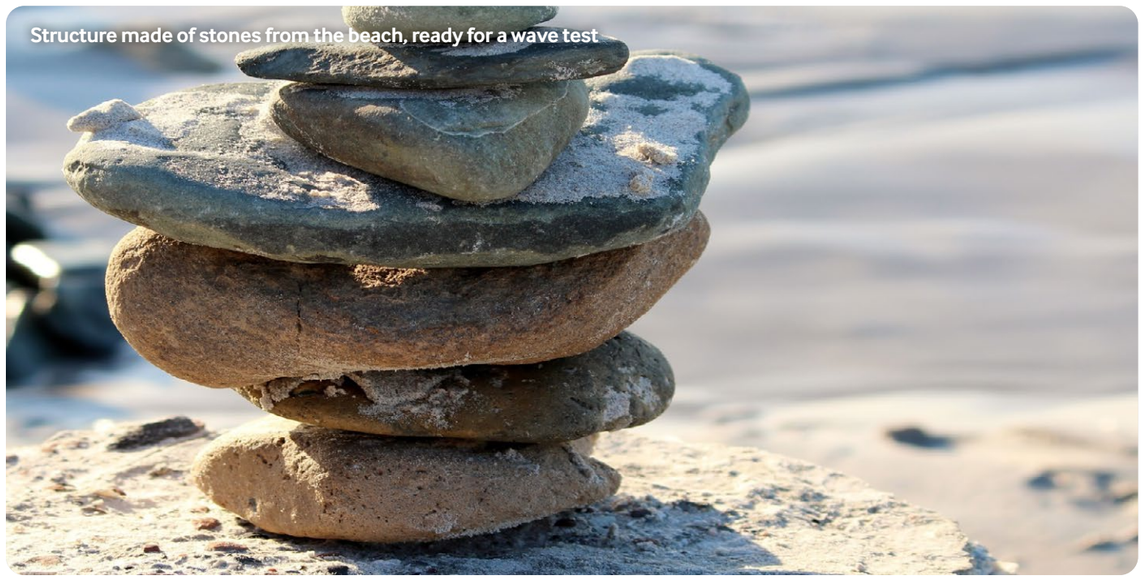
At the beach

WHAT TO DO

- On arrival at the beach, ask the children to look around and identify any built structures they can see on or near the beach.
- Prompt them to observe what materials these structures are made from.
- Discuss how these structures stay up and what external forces they might need to withstand, and then prompt them to think about how the materials used and the design of the structure help resist these forces.
- Give the children boundaries for an area in which to collect materials that they could use to build a structure. They might find natural materials such as up on the beach.
- Tell the children that they are going to work in groups to build a structure that can withstand being hit by waves – they will simulate these with buckets of water.
- Ask them to discuss with their groups which materials and objects they will choose and why they are choosing them.
- In groups, the children build their structures. Give each group time to look at what other groups have made and talk about whether they will be stable when they are hit by waves.
- Prompt each group in turn to simulate a test of the stability of their structure against the power of waves by throwing buckets of water at the structure and observing what happens.
- If it is safe to do so and time allows, the children could build their structures in a line along the beach and observe what happens to them when the tide comes in.
- For a second activity looking at structures, the children can investigate what type of sand makes the most stable sandcastle.
- Give the children an individual egg holder from a cut-up cardboard egg carton and ask them to think about where on the beach the sand would be best for making a sandcastle that would hold its shape.
- Prompt them to use the egg carton to make mini-sandcastles in different parts of the beach, observing as they do so what the sand is like.
- Ask them to discuss what kind of sand made the best sandcastle and why they think that this is.
- It might be helpful to take photographs of their structures and sandcastles to use as a prompt back in the classroom.

KEY QUESTIONS

- What sort of structures can you see? How do they stay up? What happens to them when it is windy, or when they are bashed by waves?
- Can you see evidence of how the waves have changed objects on the beach or the shape of the beach?
- How will you make a stable structure? Where on the beach will you build it? What materials will you use and why? Will you use natural or manufactured materials or both? What shape will you make your structure? How will it stay up when it is bashed by waves?
- What would you do next time to improve the stability of your structure? Why would that help?
- What kind of sand do you think makes the most stable sandcastle? Where on the beach do you think it would be best to make sandcastles? Why?



Structure made of stones from the beach, ready for a wave test

Back in the classroom

EXTENDING LEARNING

- Find out more about buildings and how engineers work out how to make sure the building doesn't fall down.
- Research buildings such as lighthouses and piers, which are built to withstand the force of waves.
- Investigate making mini castles using egg boxes out of soils from around the school grounds and compare this with making them out of sand at the beach.

FURTHER RESOURCES RELATED TO 'WAVE GOODBYE'

Primary science teaching trust resources

- **Science at Work** - Meet two engineers (a structural and a civil engineer)
- **Science for One** - Castles in the Sand (in 'Egg Box' activity sheet)
- **Starters for Science** - Paper Towers
- **The Big Jurassic Classroom** - resources to support the teaching of rocks, fossils and evolution

Explorify activities

- **Sandcastle**
- **Newspaper towers**
- **Build a bridge**

Background science for teachers

Beaches are natural habitats that are constantly shaped and reshaped by the forces of nature, including waves, tides, and storms. Along with natural features such as sand dunes, rocks and pools, beaches can also have temporary or permanent built structures that serve various purposes. Some are recreational, e.g. beach huts, beach chairs or umbrellas, or larger structures such as piers, and others are for safety, e.g. towers for lifeguards to watch over swimmers.

Sometimes structures are built on or around beaches to protect the natural habitat and the living things within it, e.g. boardwalks, and quays and harbour walls are built to create a calm, safe area for boats to enter and exit. Often, seawalls are visible on beaches. These are structures built along the shoreline to protect the cliffs from erosion or storm surges. This is important where there are houses built close to the edge of the cliffs. Erosion of the shoreline can also be prevented by building groynes which are a series of low walls or barriers built perpendicular to the shoreline on a beach. They are typically made of wood, concrete or rocks and trap sand and other sediment carried by waves.

All structures are subjected to forces, such as gravity, wind and earthquakes, which can cause stress and deformation of a building, so engineers must design structures that can resist these forces and remain stable. They must also choose the appropriate materials and ensure that they are used efficiently, and use shapes that give maximum strength and stability, e.g. a triangle is a very strong shape that is often used in bridge design.

Building on beaches brings extra challenges, e.g. coastal erosion, sea level rise, storm damage and wind load, and strategies to minimise the risk of damage or destruction are often used to overcome these, e.g. dune restoration, beach regeneration, building on stilts, installation of reinforced windows and storm shutters. The ground on and near a beach can be unstable and may require special foundations to ensure stability and prevent settling or shifting of the building. Rusting at the seaside is a common problem as the salt water and humid environment accelerate the corrosion of metals, so the use of non-corrosive metals plus regular maintenance is important.

THE SEASHORE CODE

Show respect for living things on the seashore

Leave all living animals and plants where you found them

If you overturn any rocks, carefully put them back

Make sure that a shell is empty if you take it home

Respect the sea and check the tide times

Stay away from the cliffs

Leave only footprints – take all your litter with you

Primary Science Teaching Trust

Image by: https://tinyurl.com/54na77pe

This customised geological map has been exported from the British Geological Survey's interactive Make-a-map resource

Seashore Science lesson links to UK curricula

1. IT'S A JUNGLE OUT THERE!

AGE (years)	ENGLAND	SCOTLAND	WALES	NORTHERN IRELAND
3-5	**The natural world** Explore the natural world around them, making observations and drawing pictures of animals and plants.	**Biological systems** I can identify my senses and use them to explore the world around me.	**Belonging** I am learning to recognise similarities and differences.	**World around us** Show interest in and care for their environment.
5-7	**Living things and their habitats** Identify that most living things live in habitats to which they are suited and describe how different habitats provide for the basic needs of different kinds of animals and plants, and how they depend on each other.	**Planet Earth** I have observed living things in the environment over time and am becoming aware of how they depend on each other.	**World around us** I can explore the environment, make observations and communicate my ideas.	**Interdependence** What am I? Am I the same as everyone else? What else is living? How do living things survive?
7-9	**Living things and their habitats** Recognise that living things can be grouped in a variety of ways. Explore and use classification keys to help group, identify and name a variety of living things in their local and wider environment.	**Planet Earth** I can distinguish between living and non-living things. I can sort living things into groups and explain my decisions.	**World around us** I can recognise that plants and animals are living things which grow.	**Interdependence** How plants and animals rely on each other within the natural world. **Place** How place influences plant and animal life.
9-11	**Living things and their habitats** Describe how living things are classified into broad groups according to common observable characteristics and based on similarities and differences, including micro-organisms, plants and animals.	**Planet Earth** I can identify and classify examples of living things, past and present, to help me appreciate their diversity. I can relate physical and behavioural characteristics to their survival or extinction.	**World around us** I can describe the features of organisms and recognise how they allow them to live, grow and reproduce for survival in their environment.	**Interdependence** How living things rely on each other within the natural world. **Place** Ways in which people, plants and animals depend on the features and materials in places and how they adapt to their environment.

2. SEASHORE SAFARI

AGE (years)	ENGLAND	SCOTLAND	WALES	NORTHERN IRELAND
3-5	**The natural world** Explore the natural world around them, making observations and drawing pictures of animals and plants.	**Biological systems** I can identify my senses and use them to explore the world around me.	**Belonging** I am learning to take care of things in my environment, living and non-living.	**World around us** Care for and respect living things and handle them sensitively.
5-7	**Living things and their habitats** Identify and name a variety of plants and animals in their habitats, including micro-habitats.	**Planet Earth** I can distinguish between living and non-living things. I can sort living things into groups and explain my decisions.	**Being curious** I can explore the environment, make observations and communicate my ideas.	**Interdependence** Show curiosity about the living things, places, objects and materials in the environment.
7-9	**Living things and their habitats** Recognise that living things can be grouped in a variety of ways. Explore and use classification keys to help group, identify and name a variety of living things in their local and wider environment.	**Planet Earth** I can distinguish between living and non-living things. I can sort living things into groups and explain my decisions.	**World around us** I can explore relationships between living things, their habitats and their life cycles.	**Interdependence** How plants and animals rely on each other within the natural world. **Place** Ways in which living things depend on and adapt to their environment.
9-11	**Living things and their habitats** Describe how living things are classified into broad groups according to common observable characteristics and based on similarities and differences, including micro-organisms, plants and animals. Give reasons for classifying plants and animals based on specific characteristics.	**Planet Earth** I can identify and classify examples of living things, past and present, to help me appreciate their diversity. I can relate physical and behavioural characteristics to their survival or extinction.	**World around us** I can describe how living things compete for specific resources and depend on each other for survival.	**Interdependence** How living things rely on each other within the natural world.

Seashore Science lesson links to UK curricula

3. WHAT'S FOR DINNER?

AGE (years)	ENGLAND	SCOTLAND	WALES	NORTHERN IRELAND
3-5	**The natural world** Explore the natural world around them, making observations and drawing pictures of animals and plants.	**Planet Earth** I have observed living things in the environment over time and am becoming aware of how they depend on each other.	**Exploration** I am learning to use my senses to explore the world around me.	**World around us** World around us Care for and respect living things and handle them sensitively.
5-7	**Living things and their habitats** Describe how animals obtain their food from plants and other animals, using the idea of a simple food chain, and identify and name different sources of food.	**Planet Earth** I can explore examples of food chains and show an appreciation of how animals and plants depend on each other for food.	**World around us** I can recognise that plants and animals are living things which grow.	**Interdependence** What am I? Am I the same as everyone else? What else is living? How do living things survive?
7-9	**Animals, including humans** Construct and interpret a variety of food chains, identifying producers, predators and prey.	**Planet Earth** I can explore examples of food chains and show an appreciation of how animals and plants depend on each other for food.	**World around us** I can explore relationships between living things, their habitats and their life cycles.	**Interdependence** How plants and animals rely on each other within the natural world. **Place** Ways in which living things depend on and adapt to their environment.
9-11		**Planet Earth** I can use my knowledge of the interactions and energy flow between plants and animals in ecosystems, food chains and webs.	**World around us** I can describe how living things compete for specific resources and depend on each other for survival.	**Interdependence** How living things rely on each other within the natural world.

4. CLEVER CAMOUFLAGE

AGE (years)	ENGLAND	SCOTLAND	WALES	NORTHERN IRELAND
3-5	**The natural world** Explore the natural world around them, making observations and drawing pictures of animals and plants.	**Biological systems** I can identify my senses and use them to explore the world around me.	**Belonging** I am learning to notice similarities and differences in people, places and things.	**World around us** Care for and respect living things and handle them sensitively.
5-7	**Living things and their habitats** Identify that most living things live in habitats to which they are suited and describe how different habitats provide for the basic needs of different kinds of animals and plants, and how they depend on each other.	**Planet Earth** I have observed living things in the environment over time and am becoming aware of how they depend on each other.	**World around us** I can recognise that plants and animals are living things which grow.	**Interdependence** What am I? Am I the same as everyone else? What else is living? How do living things survive?
7-9	**Living things and their habitats** Recognise that environments can change and that this can sometimes pose dangers to living things.	**Planet Earth** I have observed living things in the environment over time and am becoming aware of how they depend on each other.	**World around us** I can describe how living things compete for specific resources and depend on each other for survival.	**Place** Ways in which living things depend on and adapt to their environment. How animals use colour to adapt to their natural environment.
9-11	**Evolution and inheritance** Identify how animals and plants are adapted to suit their environment in different ways and that adaptation may lead to evolution.	**Planet Earth** I can identify and classify examples of living things, past and present, to help me appreciate their diversity. I can relate physical and behavioural characteristics to their survival or extinction.	**World around us** I can describe the features of organisms and recognise how they allow them to live, grow and reproduce for survival in their environment.	**Interdependence** Ways in which people, plants and animals depend on the features and materials in places and how they adapt to their environment.

Seashore Science lesson links to UK curricula

5. SAVE OUR SEASHORE

AGE (years)	ENGLAND	SCOTLAND	WALES	NORTHERN IRELAND
3-5	**The natural world** Know some similarities and differences between the natural world around them and contrasting environments.	**Topical science** I can talk about science stories to develop my understanding of science and the world around me.	**Belonging** I am learning to take care of things in my environment, living and non-living.	**World around us** Show an awareness of some environmental and safety issues.
5-7	**Living things and their habitats** Identify that most living things live in habitats to which they are suited and describe how different habitats provide for the basic needs of different kinds of animals and plants, and how they depend on each other.	**Topical science** I have contributed to discussions of current scientific news items to help develop my awareness of science.	**Being curious** I can recognise that what I do, and the things I use, can have an impact on my environment and on living things.	**Interdependence** Identify similarities and differences between living things, places, objects and materials.
7-9	**Living things and their habitats** Recognise that environments can change and that this can sometimes pose dangers to living things.	**Topical science** I have contributed to discussions of current scientific news items to help develop my awareness of science.	**Being curious** I can recognise that what I do, and the things I use, can have an impact on my environment and on living things.	**Interdependence** Interdependence of people and the environment. **Place** Positive and negative effects of people on places.
9-11		**Planet Earth** I can relate physical and behavioural characteristics to their survival or extinction. **Topical science** I can report and comment on current scientific news items to develop my knowledge and understanding of topical science.	**Being curious** I can understand how my actions and the actions of others impact on the environment and living things. **World around us** I can identify the threats to the development and health of organisms and recognise some natural defences, preventions and treatments.	**Interdependence** The effect of people on the natural and built environment over time. **Place** Positive and negative effects of natural and human events upon place over time.

6. MERMAIDS' PURSES

AGE (years)	ENGLAND	SCOTLAND	WALES	NORTHERN IRELAND
3-5	**The natural world** Explore the natural world around them, making observations and drawing pictures of animals and plants.	**Biological systems** I can identify my senses and use them to explore the world around me.	**Belonging** I am learning to take care of things in my environment, living and non-living.	**World around us** Care for and respect living things and handle them sensitively.
5-7	**Animals including humans** Notice that animals, including humans, have offspring which grow into adults.	**Planet Earth** I can distinguish between living and non-living things. I can sort living things into groups and explain my decisions.	**World around us** I can recognise that plants and animals are living things which grow.	**Interdependence** What am I? Am I the same as everyone else? What else is living? How do living things survive? Understand that some things change over time.
7-9		**Planet Earth** I can identify and classify examples of living things, past and present, to help me appreciate their diversity.	**World around us** I can explore relationships between living things, their habitats and their life cycles.	**Interdependence** How plants and animals rely on each other within the natural world.
9-11	**Animals including humans** Describe the life process of reproduction in some plants and animals.	**Inheritance** By investigating the life cycles of plants and animals, I can recognise the different stages of their development.	**World around us** I can describe the features of organisms and recognise how they allow them to live, grow and reproduce for survival in their environment.	**Change over time** The main stages in the life cycle of some living things. Obvious changes that occur in life cycles.

Seashore Science lesson links to UK curricula

7. WHOSE HOUSE?

AGE (years)	ENGLAND	SCOTLAND	WALES	NORTHERN IRELAND
3-5	**The natural world** Explore the natural world around them, making observations and drawing pictures of animals and plants.	**Biological systems** I can identify my senses and use them to explore the world around me.	**Exploration** I am learning to notice similarities and differences in people, places and things.	**World around us** Care for and respect living things and handle them sensitively.
5-7	**Living things and their habitats** Explore and compare the differences between things that are living, dead, and things that have never been alive.	**Planet Earth** I can distinguish between living and non-living things. I can sort living things into groups and explain my decisions.	**Being curious** I can explore the environment, make observations and communicate my ideas.	**Interdependence** What am I? Am I the same as everyone else? What else is living? How do living things survive?
7-9	**Animals including humans** Identify that humans and some other animals have skeletons and muscles for support, protection and movement.	**Planet Earth** I can distinguish between living and non-living things. I can sort living things into groups and explain my decisions.	**World around us** I can recognise that what I do, and the things I use, can have an impact on my environment and on living things.	**Place** Ways in which living things depend on and adapt to their environment.
9-11	**Living things and their habitats** Describe how living things are classified into broad groups according to common observable characteristics and based on similarities and differences, including micro-organisms, plants and animals.	**Planet Earth** I can identify and classify examples of living things, past and present, to help me appreciate their diversity. I can relate physical and behavioural characteristics to their survival or extinction.	**World around us** I can describe how living things compete for specific resources and depend on each other for survival. I can describe the features of organisms and recognise how they allow them to live, grow and reproduce for survival in their environment.	**Interdependence** How living things rely on each other within the natural world.

8. GOING, GOING, GONE?

AGE (years)	ENGLAND	SCOTLAND	WALES	NORTHERN IRELAND
3-5	**The natural world** Know some similarities and differences between the natural world around them and contrasting environments, drawing on their experiences and what has been read in class.	**Topical Science** I can talk about science stories to develop my understanding of science and the world around me.	**Exploration** I am learning to explore the properties of materials.	**World around us** Show an awareness of some environmental and safety issues.
5-7	**Everyday materials and their uses** Identify and name a variety of everyday materials, including wood, plastic, glass, metal, water, and rock.	**Materials** I can take appropriate action to ensure conservation of materials and resources considering the impact of my actions on the environment.	**Being curious** I can recognise that what I do, and the things I use, can have an impact on my environment and on living things..	**Change Over Time** Understand that different materials behave in different ways, have different properties and can be used for different purposes.
7-9	**Living things and their habitats** Recognise that environments can change and that this can sometimes pose dangers to living things.	**Materials** I can take appropriate action to ensure conservation of materials and resources considering the impact of my actions on the environment.	**Being curious** I can understand how my actions and the actions of others impact on the environment and living things. **Matter** I can explore and describe the properties of materials and justify their uses.	**Change Over Time** Ways in which change occurs in the natural world. Positive change and how we have a responsibility to make an active contribution.
9-11	**Properties and changes of materials** Compare and group together everyday materials on the basis of their properties.		**Being curious** I can recognise that our planet provides natural materials and can explain why they may have been processed to make them useful. **Matter** I can recognise that changes in materials affect their properties and uses under different conditions.	**Change over time** How some materials can change or decay while others do not. How waste can be reduced, reused or recycled and how this can be beneficial.

Seashore Science lesson links to UK curricula

9. NURDLE HUNT

AGE (years)	ENGLAND	SCOTLAND	WALES	NORTHERN IRELAND
3-5	**The natural world** Understand some important processes and changes in the natural world around them, including the seasons and changing states of matter.	**Biological systems** I can identify my senses and use them to explore the world around me.	**Ethical, informed citizens** I am learning to understand and consider the impact of their actions when making choices and acting show their commitment to the sustainability of the planet.	**World around us** Show interest in and care for their environment.
5-7	**Everyday materials and their uses** Identify and name a variety of everyday materials, including wood, plastic, glass, metal, water, and rock.	**Materials** I can take appropriate action to ensure conservation of materials and resources, considering the impact of my actions on the environment.	**Being curious** I can explore the environment, make observations and communicate my ideas.	**Change over time** Understand that some materials change if kept in different conditions.
7-9	**Living things and their habitats** Recognise that environments can change and that this can sometimes pose dangers to living things.	**Materials** I have participated in practical activities to separate simple mixtures of substances and can relate my findings to my everyday experience.	**World around us** I can recognise that what I do, and the things I use, can have an impact on my environment and on living things.	**Progression** Changes in the local environment including how they can affect living things.
9-11	**Properties and changes of materials** Use knowledge of solids, liquids and gases to decide how mixtures might be separated, including through filtering, sieving and evaporating.	**Materials** I have participated in practical activities to separate simple mixtures of substances and can relate my findings to my everyday experience.	**Being curious** I can understand how my actions and the actions of others impact on the environment and living things.	**Interdependence** The effect of people on the natural and built environment over time. **Place** Positive and negative effects of natural and human events upon place over time.

10. THE POWER OF THE SEA

AGE (years)	ENGLAND	SCOTLAND	WALES	NORTHERN IRELAND
3-5	**The natural world** Understand some important processes and changes in the natural world around them, including the seasons and changing states of matter.	**Topical Science** I can talk about science stories to develop my understanding of science and the world around me.	**Exploration** I am learning to explore the properties of materials.	**World around us** Observe, explore and investigate materials.
5-7	**Everyday materials** Identify and name a variety of everyday materials, including wood, plastic, glass, metal, water, and rock.	**Materials** I can take appropriate action to ensure conservation of materials and resources considering the impact of my actions on the environment.	**Matter** I can explore the properties of materials and choose different materials for a particular use.	**Change Over Time** How do things change? What kind of changes happen, have happened or might happen?
7-9	**Rocks** Compare and group together different kinds of rocks on the basis of their appearance and simple physical properties.	**Materials** Having explored the substances that make up Earth's surface, I can compare some of their characteristics and uses.	**Matter** I can explore and describe the properties of materials and justify their uses.	**Change Over Time** Ways in which change occurs in the natural world.
9-11	**Properties and changes of materials** Compare and group together everyday materials on the basis of their properties.	**Materials** Having explored the substances that make up Earth's surface, I can compare some of their characteristics and uses.	**Matter** I can recognise that changes in materials affect their properties and uses under different conditions.	**Change over time** Ways in which change occurs over both short and long periods of time in the physical and natural world.

Seashore Science lesson links to UK curricula

11. WET, WET, WET

AGE (years)	ENGLAND	SCOTLAND	WALES	NORTHERN IRELAND
3-5	**The natural world** Understand some important processes and changes in the natural world around them, including the seasons and changing states of matter.	**Planet Earth** By investigating how water can change from one form to another, I can relate my findings to everyday experiences.	**Belonging** I am learning to take care of things in my environment, living and non-living.	**World around us** Talk about their observations and make simple predictions about things, for example what would happen if water was added to sand.
5-7	**Everyday materials** Describe the simple physical properties of a variety of everyday materials.	**Planet Earth** By investigating how water can change from one form to another, I can relate my findings to everyday experiences.	**Being curious** I can explore the environment, make observations and communicate my ideas.	**Change over time** How do things change? What kind of changes happen, have happened or might happen?
7-9	**States of matter** Identify the part played by evaporation and condensation in the water cycle and associate the rate of evaporation with temperature.	**Planet Earth** I have participated in practical activities to separate simple mixtures of substances and can relate my findings to my everyday experience.	**Matter** I can observe and describe ways in which materials change when they are mixed together.	**Change over time** Ways in which change occurs in the natural world.
9-11	**Properties and changes of materials** Demonstrate that dissolving, mixing and changes of state are reversible changes.	**Planet Earth** I can apply my knowledge of how water changes state to help me understand the processes involved in the water cycle in nature over time.	**Matter** I can recognise that changes in materials affect their properties and uses under different conditions.	**Change over time** Ways in which change occurs over both short and long periods of time in the physical and natural world. Changes of state in the water cycle.

12. SALTY SITUATION

AGE (years)	ENGLAND	SCOTLAND	WALES	NORTHERN IRELAND
3-5	**The natural world** Understand some important processes and changes in the natural world around them, including the seasons and changing states of matter.	**Planet Earth** By investigating how water can change from one form to another, I can relate m findings to everyday experiences.	**Exploration** I am learning to notice similarities and differences in people, places and things.	**World around us** Talk about their observations and make simple predictions about things.
5-7	**Everyday materials** Identify and name a variety of everyday materials, including wood, plastic, glass, metal, water, and rock.	**Planet Earth** I can make and test predictions about solids dissolving in water and can relate my findings to the world around me.	**Being curious** I can explore the environment, make observations and communicate my ideas.	**Change Over Time** Understand that some materials change if kept in different conditions.
7-9	**States of matter** Identify the part played by evaporation and condensation in the water cycle and associate the rate of evaporation with temperature.	**Materials** I can apply my knowledge of how water changes state to help me understand the processes involved in the water cycle in nature over time.	**Matter** I can observe and describe ways in which materials change when they are mixed together.	**Change Over Time** Ways in which change occurs in the natural world.
9-11	**Properties and changes of materials** Know that some materials will dissolve in liquid to form a solution, and describe how to recover a substance from a solution. Demonstrate that dissolving, mixing and changes of state are reversible changes.	**Materials** By investigating common conditions that increase the amount of substance that will dissolve or the speed of dissolving, I can relate my findings to the world around me.	**Matter** I can recognise that changes in materials affect their properties and uses under different conditions.	**Change over time** Ways in which change occurs over both short and long periods of time in the physical and natural world. Changes of state in the water cycle.

Seashore Science lesson links to UK curricula

13. BOBBING ALONG

AGE (years)	ENGLAND	SCOTLAND	WALES	NORTHERN IRELAND
3-5	**The natural world** Explore the natural world around them, making observations and drawing pictures of animals and plants.	**Forces** Through everyday experiences and play with a variety of toys and other objects, I can recognise simple types of forces and describe their effects.	**Exploration** I am learning to explore the properties of materials.	**World around us** Ask questions about why things happen and how things work.
5-7	**Everyday materials** Describe the simple physical properties of a variety of everyday materials.	**Forces** Through everyday experiences and play with a variety of toys and other objects, I can recognise simple types of forces and describe their effects.	**Being curious** I can explore the environment, make observations and communicate my ideas.	**Movement and energy** Why do things move? Where do things move? How do things work?
7-9		**Forces** By investigating floating and sinking of objects in water, I can apply my understanding of buoyancy to solve a practical challenge.	**Forces and Energy** I can communicate the effect forces have on myself and on objects.	**Movement and energy** Changes in movement and energy over time.
9-11	**Forces** Identify the effects of air resistance, water resistance and friction, that act between moving surfaces.	**Forces** By investigating floating and sinking of objects in water, I can apply my understanding of buoyancy to solve a practical challenge.	**Forces and Energy** I can use a variety of simple models to describe the forces acting on an object.	**Movement and energy** The causes and effect of energy, forces and movement.

14. SOUNDS OF THE SEASHORE

AGE (years)	ENGLAND	SCOTLAND	WALES	NORTHERN IRELAND
3-5	**The natural world** Explore the natural world around them, making observations and drawing pictures of animals and plants.	**Forces, electricity and waves** Through play, I have explored a variety of ways of making sounds.	**Exploration** I am learning to use my senses to explore the world around me.	**World around us** Identify a variety of familiar sounds.
5-7		**Forces, electricity and waves** Through play, I have explored a variety of ways of making sounds.	**Being curious** I can explore the environment, make observations and communicate my ideas.	
7-9	**Sound** Identify how sounds are made, associating some of them with something vibrating. Find patterns between the pitch of a sound and features of the object that produced it. Find patterns between the volume of a sound and the strength of the vibrations that produced it.	**Forces, electricity and waves** By collaborating in experiments on different ways of producing sounds from vibrations, I can demonstrate how to change the pitch of the sound.	**Forces and energy** I can explore and communicate the basic properties of light, sound, electricity and magnetism.	**Movement and energy** Sources of energy in the world. Sounds in the local environment.
9-11		**Forces, electricity and waves** Through research on how animals communicate, I can explain how sound vibrations are carried by waves through air, water and other media.	**Forces and energy** I can explain how the properties of sound and light will affect how they are experienced. By manipulating the properties of sound and light, I can produce a desired effect.	**Movement and energy** How sound travels.

Seashore Science lesson links to UK curricula

15. WAVE GOODBYE

AGE (years)	ENGLAND	SCOTLAND	WALES	NORTHERN IRELAND
3-5	**The natural world** Understand some important processes and changes in the natural world around them, including the seasons and changing states of matter.	**Materials** Through creative play, I explore different materials and can share my reasoning for selecting materials for different purposes.	**Exploration** I am learning to explore the properties of materials.	**World around us** Observe, explore, investigate and select materials and equipment in a range of situations.
5-7	**Everyday materials** Distinguish between an object and the material from which it is made. Identify and name a variety of everyday materials.	**Materials** Through creative play, I explore different materials and can share my reasoning for selecting materials for different purposes.	**Matter** I can explore and describe the properties of materials and justify their uses.	**Change over time** Why do things move? Where do things move? How do things work?
7-9	**Rocks** Compare and group together different kinds of rocks on the basis of their appearance and simple physical properties.	**Materials** Through exploring properties and sources of materials, I can choose appropriate materials to solve practical challenges.	**Matter** I can make design decisions, using my knowledge of materials and existing products, and suggest design improvements.	**Change over time** Ways in which change occurs in the natural world.
9-11	**Forces** Identify the effects of air resistance, water resistance and friction, that act between moving surfaces.	**Materials** Having explored the substances that make up Earth's surface, I can compare some of their characteristics and uses.	**Matter** I can recognise that our planet provides natural materials and can explain why they may have been processed to make them useful. I can use a variety of simple models to describe the forces acting on an object.	**Interdependence** The effect of people on the natural and built environment over time.

"Seashore Science is simple and straightforward to use. Everything is included to enable teachers to deliver a fun and engaging practical session that challenges the children and meets requirements in the curriculum."
Project Teacher

"The key questions were brilliant, especially for supporting parent helpers, and for providing a challenge during the activities."
Project Teacher

"Seashore Science help children think about what they already know. The Power of the Sea lesson was great as they made links with their prior learning about rocks and about forces."
Project Teacher

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