

## Teacher notes to go with the PowerPoint

### 1. What is a rock pool?

Shallow pools of seawater that form along the coastline and are home to a wide variety of sea creatures. They are in the intertidal zone: covered by the sea at high tide but exposed when the tide goes out.

### 2. What do you think it is like living between the tides on a rocky shore?

Life is tough on a rocky shore as there are two high tides and two low tides each day. When the water covers the rocky shore, organisms risk being washed away by the powerful action of the waves or preyed upon by predators. When the rocky shore is exposed at low tide, the organisms are exposed to weather extremes, predation, trampling and pollution.

- Sun: heats the water up and evaporates some of the water, the salinity increases.
- Rain: reduces the salinity.
- People: accidentally stand on the creatures and can harm creatures when picking them up and putting back
- Tide: covered twice a day and drained twice a day. Lack of water means animals dry out!
- Competition: creatures fighting for space. When the tide goes out, animals trapped in the pools with the predators!

### 3. Zonation

Rocky shore plants and animals that live in the intertidal zone tend to form their own communities. Some organisms live further up the shore, closer to the high tide line, while others live further down the shore, closer to the low tide zone.

The lower down the shore you go the greater the biodiversity.

- Splash zone: this zone is rarely covered by seawater but it is exposed to sea spray. Rocks tend to be bare apart from brightly coloured lichen such as black tar lichen and yellow lichen.
- Upper shore: this zone is above the mean high water mark and covered by water at high spring tides, which come once a fortnight. This area is dominated by seaweeds such as gutweed, sea lettuce, spiral and channelled wrack. A small number of animals, such as rough and small periwinkles, hide in the crevices and acorn barnacles cover the rocks. These creatures are adapted to tolerate extreme conditions, either with a hard shell or by being permanently attached to rocks.

- Middle shore: this zone is exposed to air and then submerged in water twice a twice a day. It is affected by the action of the waves. Animals have to be tough to live here and usually try to stay as wet as possible, hiding underneath seaweed, damp crevices and overhangs. This area is dominated by bladder wrack, coral weed, serrated wrack. Animals such as flat periwinkles, common limpets, beadlet anemones, top shells, dog whelks, barnacles, shore crabs and mussels can usually be found in this zone.
- Lower shore: usually under water for most of the time, accessible for a few days during large spring tides. This is the area that has the greatest biodiversity. Different creatures are found in different zones.

#### 4. Seaweeds

##### What are seaweeds?

Seaweeds are the forests of the sea. They are not classified as plants as they do not have roots, leaves or stems. Nutrients that are needed for growth are absorbed from the water.

Some seaweeds have a stipe (stem), a blade or frond, some can be bushy with many branches. Most seaweeds have a holdfast: a small disc or interwoven roots, which anchors the seaweed to a hard surface. Some seaweeds have bladders, like bladder and egg wrack, filled with gas which makes them float.

##### Why are seaweeds important?

- Seaweeds provide a habitat for a wide variety of marine species such as cod and wrasse. They also act as an important nursery ground for young fish, safe from predators. Seaweeds provide food for grazing molluscs like top shells and sea hares, food, fodder and fertilizer for coastal communities for thousands of years.
- They protect our shores by absorbing wave action and slow coastal erosion.
- Seaweed has many health benefits, and is used in cosmetics, food and medicines.
- Scientist believe bladder wrack has anti-aging properties!
- Purple or tough laver is a favourite food in parts of Wales, where it is used to make laver bread and jelly, or rolled in oatmeal and fried in bacon fat. It is often served cold in Cornwall, doused with vinegar.

**Seaweed can be divided into three colour groups: red, green and brown.**

- Green seaweed
  - Sea Lettuce- *Ulva lactuca*: pale to dark green. Usually wider at the top than the bottom-translucent. Usually found on the upper to middle shore.
  - Gutweed- *Ulva intestinalis*: bright, grass green. The fronds are long, thin inflated tubes with narrow tips. Usually found on the lower to upper shore.
- Brown Seaweed
  - Bladderwrack – *Fucus vesiculosus*. This is a common seaweed. It has round air bladders, often appearing in pairs either side of the pronounced mid-rib which allow the seaweed to float upright underwater, this helps them exchange gases and absorb nutrients when submerged. It forms dense beds on the mid shore and provides a shelter for many creatures. It is found growing between the upper and lower shores. Bladder wrack is a food source for periwinkles.
  - Serrated wrack or toothed wrack- *Fucus serratus*. It is a common olive brown seaweed. Its name comes from the serrated edges on its fronds. It does not have air bladders and the fronds are flat not spiralled. It can be found growing in the middle to lower shore.
- Red Seaweed
  - Purple Laver -*Porphyra umbilicalis*. The purple fronds are tough and membrane-like. It attaches to the rock with a disc-like holdfast. It is a common seaweed found on rocky shores and can tolerate long periods of air exposure between tides.
  - Coral weed- *Corrallina officinalis*. Coral weeds vary in colour from pink to red. The fronds are calcareous and segmented, looking a bit like a chain of beads. They are attached to rocks by a hold fast.

## 5. Animal Life

The rocky shore is home to a wide variety of strange and wonderful marine life, many of them invertebrates; from sea squirts, sponges, molluscs and vertebrates like fish.

- Sponges
- Cnidaria
- Worms
- Crustaceans
- Molluscs
- Bryozoans
- Echinoderms
- Sea Squirts
- Fish

### Sponges

Sponges are the simplest members of the animal kingdom. Their cells are specialized for simple functions such as feeding, support or reproduction.

- Bread crumb sponge  
An encrusting sponge that can form large sheets or lumps on rocks, usually beneath overhangs. It can occur in a variety of colours from olive green to various shades of orange. They are filter feeders, eating microscopic bacteria, algae and detritus.
- Cnidaria  
Cnidarians have stinging cells, which they use for defence as well as to capture prey. They are quite simple animals. They have no true circulation system and a simple nerve system. Their tentacles are covered in stinging cells, capture prey animals and pass them to the central mouth where they are engulfed. There is no anus so the mouth is also used to get rid of waste materials. The stinging cells contain discharge capsules. Each capsule contains a long hollow coiled thread, which uncoils and shoots out when the cell is triggered by touch or a chemical stimulus.
- *Beadlet anemone- Actinia equine*  
They live attached to rocks, the base of the body acting like a sucker keeping them in place when the tide goes out. They come in a range of colours from deep red, green brown or orange. When covered with water they are a mass of tapering tentacles but at low tide resemble blobs of jelly. They retract their tentacles as a way of tolerating high temperatures, avoid drying out and to conserve energy. Look closely and you will see a ring of blue beads (acrorhagi) just below the tentacles. These acrorhagi contain stinging cells, which are important in aggression. Beadlet anemones fight each other as they compete for the best spot on rocks and will eat anything they can catch in their tentacles: shrimps, sand hoppers and small fish. They can live for more than three years.

## Worms

- Green leaf worm- *Eulalia viridis*. Bright grass green to dark green in colour and can grow up to 60cm long. This segmented worm usually hides under rocks. Look out for bright green egg capsules attached to seaweed in the rock pools. If you check under nearby rocks, you might be lucky enough to see the green leaf worm, also known as the paddle worm. Can you see the overlapping leaf shaped paddles that fringe both side of the body, which it uses to help it swim? When disturbed they can release large amounts of mucus as a defence mechanism.
- Lugworm-*Arenicola marina*. The cast of a lugworm is a common sight. Lugworms live below the sand in u-shaped burrows. They feed on organic material in muddy sand. The lugworms line their burrows with mucus to stop them collapsing.

## Bryozoans

Bryozoans means moss animals but they are usually called sea mats. They form encrusting mats on rocks and seaweeds. Their patches are made up of millions of tiny animals called zooids living together in a colony. They are filter feeders, feeding on plankton.

- Sea Mat- *Membranipora membranacea*. The sea mat grows over the fronds of kelp plants. If you look closely you can see the rectangular boxes that make up the colony. (round patch).
- Hornwrack- *Flustra foliaca*. Colony upright (looks a lot like seaweed). Smells strongly of lemons.
- Hairy sea mat- *Electra pilosa*. Growing on serrated wrack-*fucus serratus*. Note the irregular margins.

## Crustaceans

Crustacean are invertebrates. They have segmented bodies and limbs and many have a hard external body covering similar to a suit of armour known as a carapace.

Crabs, lobsters, shrimps and prawns all have the carapace enclosing the gills and other body parts and a segmented abdomen. At the front of the carapace are the eyes, often stalked and the feeding mouthparts. They have two feeding lobes; a pair of claws or pincers and four pairs of legs used for walking and sometimes swimming.

The carapace (hard shell) protects them from predators and strong waves; and provides a hard surface for crushing, cutting and grinding their prey. The sharp claws are used for feeding, and fighting off predators and other crustaceans. One disadvantage of the exoskeleton is that it has to be shed every so often to allow for growth (moult).

Many Crustaceans move off shore in the winter to avoid the damaging onshore waves.

Most crustaceans are scavengers. They eat shrimps, dead seaweed, fish and other small animals.

- Shore crab- *Carcinus maenus*. This is our most common seashore crab. It is mottle green to brown and is found in pools and amongst seaweed. It has three rounded lobes at the front of the carapace between the eyes and five 'teeth' on the shell, either side of the eyes. They also have pointed ends to the hind limbs.
- Edible or brown crab- *Cancer pagurus*. This crab is often called the brown or pie crust crab, as it has a pie crust edge to its carapace. It is a large broad crab and black tipped claws. Large males can live for more than 20 to 100 years.
- Common hermit crab- *Pagurus bernhardus*. Hermit crabs are crustaceans but they have adapted to live in empty shells. Unlike other crabs, they do not have to shed their outer skeleton to grow, they just move to a larger shell. Unlike other crabs a hermit doesn't have a shell so it lives in any empty sea snail shell. Only the head end, legs and front claws are usually seen, poking out of the shell. The head and legs are covered with small spines and bristles. The right hand pincer is the larger and is used to close the shell entrance when the hermit crab is hiding inside.
- Acorn barnacle -*Semibalanus balanoides*. Barnacles are in fact crustaceans, the hard outer casing is similar to the shell of a crab. This helps to protect them from the waves. The animal hidden within is upside down, its head permanently glued to the rock and its rear legs sticking out of the top, forming a sieve to collect drifting plankton. They have a door-like structure, which is closed at low tide, and open at high tide.

## Molluscs

Molluscs have a soft, fleshy body and a strong muscular foot. The foot can be used to attach to rocks or for burrowing. The head usually has a pair of sensory organs and parts used for feeding, which includes the radula, a ribbon of teeth, used for grazing or preying upon other animals. Molluscs may or may not have a shell which is secreted by part of the body called a mantle.

- Limpet-*Patella vulgate*. Limpets have a hard conical shell to protect them from predators. They have a strong foot gluing them to a hard surface, which helps to protect them from waves. The limpet creates a home scar on the surface of a rock by grinding their shell or rock to make a perfect fit. They are able to store water under their shells to be able to breathe out of water and avoid drying out at low tide. When the tide is in the limpets leave their home scar and graze algae nearby. The limpet has to return to their home base before the tide is out and they do this by following their trail of mucus.
- Chiton-*Lepidochitona cinerea*. Chitons are often known as coat of mail shells because of the pattern of overlapping plates along their backs, surrounded by a hardened mantle. Its shell is made up of eight arched plates, which fit very closely together. This helps them to bend and cling to uneven rocks, using a large muscular foot. They are oval in shape and generally found attached to rocks. It feeds using a radula, scraping off and eating algae attached to rocks. They will also feed on barnacle legs.
- Flat periwinkle -*Littorina obtusata*. They have smooth shells and flattened spires. Shell colour is highly variable with yellow, olive green and brown forms. Shell colour is linked to natural selection, with the particular environment determining which coloured shells are most obvious to predators. Periwinkles graze on seaweeds, on which they lay their eggs.
- Dog whelk- *nucella lapillus*. The shell is thick, has a blunt spire and broadly conical. It can be dark brown, yellow or even white. It is a fearsome predator often called the killer driller. It mainly feeds on mussels, barnacles and sometimes limpets. The dog whelk drills with a special boring organ and then turns the internal organs of its prey into a soup by injecting digestive enzymes.

## Echinoderm

Echinoderms are spiny-skinned animals, providing protection from predators. Most echinoderms have a central body and five or six distinct arms. They are able to move using tubular feet with suckers on the end.

- Common Star fish- *Asterias rubens*. It is usually dull orange in colour, has five tapering arms with scattered white spines all over the upper surface. Usually it has a line along the top of each arm. It is normally found on the middle and lower shore. It is a carnivore feeding on molluscs and crustaceans.
- Little brittle star- *Amphipholis squamata*. They are grey with long, slender, fragile arms up to 2cm long. They are found in amongst holdfasts and under rocks. They feed on detritus.

## Fish

Fish have a skeleton composed of bones. They are cold blooded. They breathe using gills, which extract oxygen from the water. Seashore fish are often well adapted to living in the intertidal zone. They may have flattened or eel-like bodies (pipe fish and plaice), spines or camouflage (scorpion fish or goby).

- Sand goby- *Pomatoschistus minutus*. This small fish pale brown or grey fish has a slender body and a large head. It feeds on small tubeworms and shrimps
- Snake pipefish- *Entelurus aequoreus*. It has a long, thin, smooth snake-like body and females can reach lengths of up to 60cm. It has an orange/brown body and silvery body rings. It has a long snout and a small dorsal fin. It is found under rocks and seaweed.
- Butterfish- *Pholis gunnellus*. It has a very slippery eel-like body, which is covered in mucus. It is yellowish to reddish brown with up to 12 black spots outlined with white along its dorsal fin. It can grow up to 25 cm long and lives under rocks, in crevices and amongst seaweeds.



## Task 2: Identify similarities and differences

Look carefully at each of the rock pool creatures, list key features.

<p><b>Shore crab</b></p> <ul style="list-style-type: none"> <li>• Hard shell</li> <li>• Gills and internal organs hidden</li> <li>• Pointed ends of legs</li> <li>• Jagged edge to shell</li> <li>• Crushing claw and cutting claw</li> <li>• Green/brown</li> </ul>	<p><b>Beadlet anemone</b></p> <ul style="list-style-type: none"> <li>• Soft body</li> <li>• Sucker-like base</li> <li>• Red</li> <li>• Tapering stinging tentacles</li> <li>• Ring of blue beads</li> </ul>
<p><b>Chiton</b></p> <ul style="list-style-type: none"> <li>• Grey/brown in colour</li> <li>• Bristles round edge of shell</li> <li>• Eight overlapping plates</li> <li>• Strong muscular foot</li> <li>• Oval shaped</li> </ul>	<p><b>Butterfish</b></p> <ul style="list-style-type: none"> <li>• Thin, flattened body</li> <li>• Covered in mucus</li> <li>• Yellow to reddish brown</li> <li>• Black spots</li> </ul>

Select two creatures and write about how the creature has adapted to life on a rocky shore.

Group the animals according to their features. Use the rock pool spotter sheet.

	<b>Sponges</b>	<b>Cnidarians</b>	<b>Worms</b>	<b>Crustaceans</b>	<b>Molluscs</b>	<b>Bryozoans</b>	<b>Echinoderm</b>	<b>Fish</b>
Features	Simple animal Cannot move Filter feeder Surface has small pores	Soft bodies Flower like animals Mouth surrounded by a circle of tentacles Tentacles have stinging cells for catching prey Solitary or colonial	Segmented body Long, soft body Bristles along the side of the body	Body divided into head, thorax and abdomen Outer body made of chitin Jointed legs	Body consists of head, muscular foot and soft body Many use a toothed radula to feed with. Mantle (shell) covers soft body parts.	Live in groups-colonies Mesh/lacy appearance Filter feeders	Slow moving Brightly coloured Spiny skinned Long, flexible tubed feet.	Body covered in scales or a layer of slime Internal skeleton and backbone
Animal Groups	Breadcrumb sponge	Beadlet anemone Jelly fish	Green leaf worm Sandmason	Shore crab Edible crab Hermit crab Prawn	Limpet Whelk Periwinkle Chiton Sea hare	Sea mat	Starfish Brittle star	Butter fish Plaice

### Task 3: Design and make a rock pool

Materials to use:

- Container to model the rock pool in
- Plastic to line to container
- Cat litter (quartz and limestone)
- Clay
- Modelling clay
- Glue
- Water colour paints and sponges

Method:

1. Line your container with plastic
2. Mix the cat litter and glue to a thick paste. Add the mixture to the container.
3. Mould the mixture so it resembles the bottom of a rock pool: add in gullies/crevices and overhangs. Leave to dry. Build up in layers.
4. Once dry, cover it with a thin layer of clay. Leave to dry.
5. Sponge paint.
6. Use modelling clay to make the sea creatures.

