Conservation Education

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Suite 29 Yeovil Innovation Centre,
Barracks Close, Copse Road, Yeovil,
Somerset, BA22 8RN
Tel: 01935 385962
Email: info@ypte.org.uk
Web site: www.ypte.org.uk
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Founder: Cyril Littlewood MVO, MBE, OGA
Director: Peter Littlewood

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Contents

Peter Littlewood writes...

The Rocky Shore – the coastline of Britain is approximately 10,000 miles in length, and highly varied in nature, with sandy beaches, rocky shores, cliffs, shingle and estuaries are just some of the habitats one can find along its length.

Each kind of shore has its own beauties to reveal, but perhaps the most fascinating treasure houses of all are the rockpools found along many stretches of our coastline. Rockpools come in all shapes and sizes, each one a fragile ecosystem that is covered by tides twice a day.

Rockpools make fantastic areas for outdoor study, aided by the fact that many of the animals that live in them are fairly easy to catch. There are few practical environmental sessions which create more excitement and interest than rockpool study, simply because the students can engage directly with their subject. However, many rockpool-dwelling creatures are also easy to harm, so every care must be taken when handling them.

Making sure that your catches have a safe environment while they are being studied is of great importance. Shallow plastic sample trays filled with water are ideal for observation, but need a few rocks and some seaweed under the shade of which creatures can take shelter. Prolonged exposure to heat and sunlight can be quite harmful to your catches, so make your observations quickly and release them again safely into the same pool they were found in.

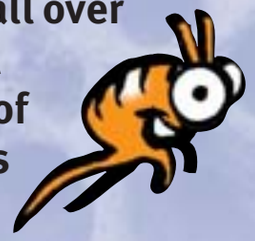
Wherever possible, it is kinder to observe the creatures in situ, both by watching a rockpool and perhaps by gently lifting weed and stones to see what they conceal. Always replace them again with as little disturbance as possible.

Rockpools are wonderful places, but remember safety is important. Make sure the students are appropriately dressed and that you have the correct equipment. Know the tide times, and visit the rockpools at low tide if possible, as this is when you will see the most. Always ensure the safety of any animals you catch.

Mostly though, take the opportunity to enjoy studying a wonderful and accessible environment – the rocky shore.

A Rocky Shore Ecosystem

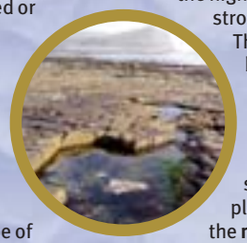
Rocky coastlines are found all over the world but they are not all the same. Some are made up of steep, rocky cliffs whilst others slope gently into the sea.



These craggy seashores have been formed by the force of the sea pounding against hard cliff faces, gradually breaking them up and wearing them away. This continuous action is called **erosion**. The shore may consist of rocky ledges with cracks and hollows that form pools as they fill with salty water. The sea breaks part of the rocky cliffs into boulders and pebbles that are finally ground into grains of sand.

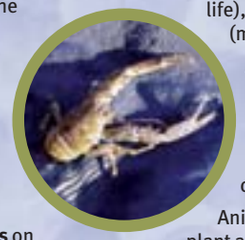
Living in this seaside **habitat** is a **community** of hardy plants and animals, and each species is specially adapted for coping with the harsh environment around it. The plants and animals interact with each other and with their non-living surroundings (the habitat) to form the rocky shore **ecosystem**.

Depending on its situation, a rocky shore may be in an exposed or sheltered area. Of all the seashore habitats, the sheltered rocky shore has the greatest number of species and therefore is probably the best type to study.



Life is difficult on the seashore because this type of habitat changes every day. The organisms (the plants and animals) on the rocks in the **intertidal zone** (the area exposed between high and low tides) have to survive the continual cycle of changing tides that may leave them high and dry for ten hours or more between high tides. When the tide rolls in, these organisms must be able to withstand the waves that often hit with incredible force – and they have to cope with being submerged in salty water for several hours.

Spring tides (from the Old English word 'springen', to rise) occur every two weeks at times of the full and new moon. The best time to study the shore is during these tides as they rise further up and drop lower down the shore than **neap tides**, which happen between spring tides.



Seashore life occurs in **zones** on the shore, according to how well the different species can tolerate exposure to air and sunlight. Above the level of the highest tides is the **splash zone**, strongly affected by salt spray. The **upper shore** is not covered by every high tide, usually only those of spring tides. Very few species can tolerate the relatively dry conditions of the upper shore. Most seashore plants and animals live in the **middle shore**, the main area that is covered and uncovered by every tide. The **lower shore** is only exposed during the low tides of spring tides and the plants and animals that live here are more like those that live deeper in the sea.

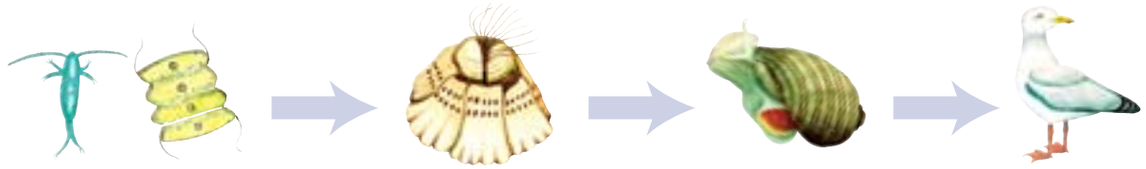
A high tide brings food and nutrients to the organisms living further up the shore and when it goes out waste products are taken with it and washed away.

Animals in an ecosystem obtain the energy they need by eating plants, or other animals that have eaten plants. The plants themselves get their energy from the sun.

Animals that feed mainly on plants are called **herbivores** and most seashore herbivores, like the **limpet**, feed on young seaweeds. Others, for example **zooplankton** (microscopic animal life), feed on **phytoplankton** (microscopic plant life).

Animals that feed mainly on other animals are called **carnivores**. They are often called 'predators' and the animals they feed on are called their 'prey'.

Animals that feed on both plant and animal material are called **omnivores**. On the seashore many types of animals are omnivores because they feed by filtering both phytoplankton and zooplankton from the seawater.



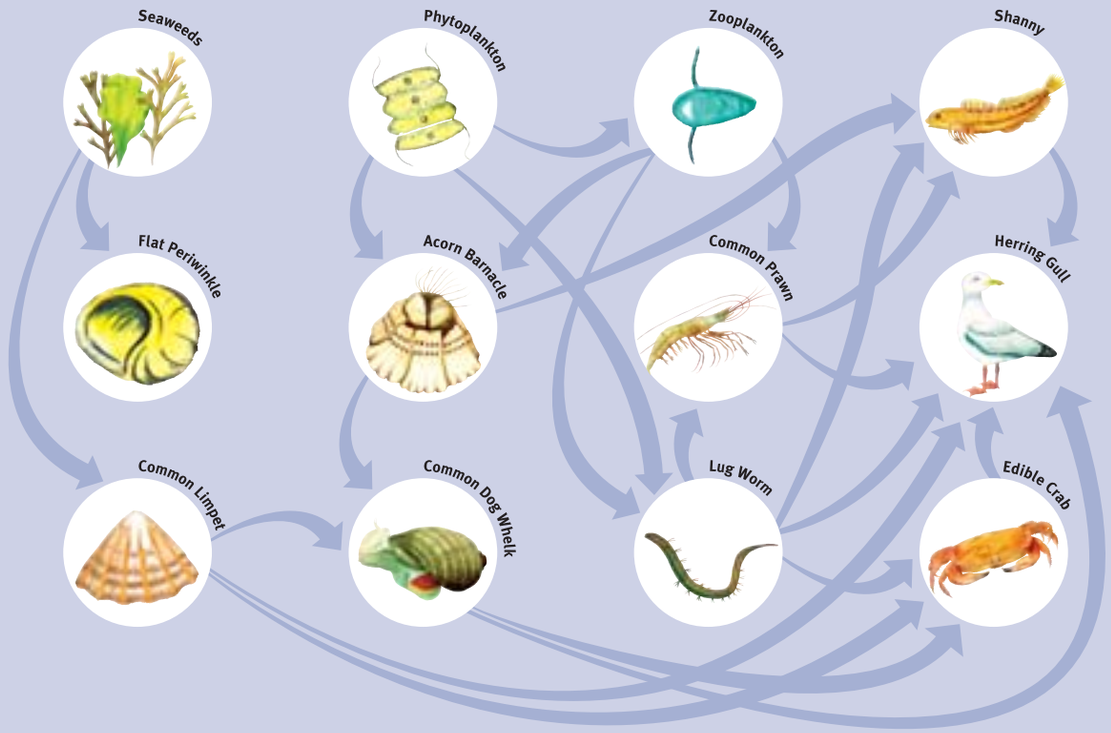
When a herbivore eats a plant... and then the carnivore eats the herbivore... the sequence of events is called a **food chain**. Each organism is a link in a chain.

The animal at the top of a food chain is often called a 'top predator' because it is not normally eaten by anything. In a rocky shore ecosystem there may be hundreds of food chains. Above is an example:-

The dog whelk and the herring gull will eat other animals too. There are so many connections between food chains that we can think of every organism as part of a complicated **food web** rather than as a link in a straight chain.

Rocky Shore Food Web

How many food chains can you find in this web?



Seaweeds of the Rocky Shore

Seaweeds belong to a group of primitive plants known as algae. They do not have leaves, stems, roots and flowers but have fronds that are anchored to rocks and other solid objects by a holdfast.

Like land plants, they contain the green substance called **chlorophyll** so they are able to make their own food by the process known as photosynthesis.

Several types of seaweeds grow in the intertidal zone and they are specially adapted to be able to live for lengthy periods out of the water. They produce a slimy substance that coats their fronds and helps to prevent them from drying out. The position on the shore where a species lives depends on the length of time the shore is exposed to the air. Some seaweeds are able to live almost totally in the air, while others can survive for only a very brief period out of the sea.

There are three main groups of seaweed – **green, brown and red**. Generally speaking, the green seaweeds, such as **sea lettuce**, are found on the upper shore, or growing beneath brown seaweeds on the middle shore, and in pools. Brown seaweeds are found on the middle shore to lower shore, and red seaweeds are mainly on the lower shore. The reds need very little light and often grow in deeper rock pools or attached to brown seaweeds out at sea. A few red weeds, such as **coral weed**, can survive in rock pools higher up the shore and withstand periods of drying out.

The brown seaweeds, usually called **wracks**, dominate the shore. The **channelled wrack** lives on rocks on the upper shore as it can withstand drying out completely. The **spiral wrack**, so-called because it twists into spirals as it dries out and dies, lives in the middle shore because it can only survive in the air for a few hours. The **bladder wrack** also lives on the middle shore and the **serrated** or **toothed wrack** is found nearest the sea as it can only live for a very short time exposed to the air.

The biggest brown seaweeds are the **kelps**, such as **oarweed** and **sea belt**, and these mark the bottom of the intertidal zone, growing anchored to rocks below the surface of the sea. They quickly die if exposed to dry air and are only briefly uncovered by the lowest spring tides.

All the seaweeds provide food and shelter for many of the seashore animals.

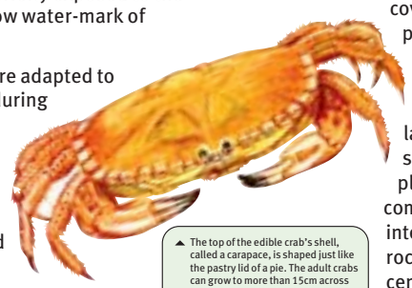
▲ The bubbles on the fronds of the knotted wrack seaweed are air bladders which help the fronds to float up to the surface of the water. This allows the plant to absorb plenty of sunlight so it can photosynthesise more easily.

Animals of the Rocky Shore

As we have seen, the seaweeds of a rocky shore grow in different areas – zones – depending on their ability to survive out of the water. The animals show a similar zonation, but because they can move around it is not so obvious.

Like the plants, the animals are greatly influenced by the tide. Some species live almost as land animals around the high water-mark of spring tides, and others are only briefly exposed to the open air at the low water-mark of spring tides.

All the animals are adapted to feed and breed during the few hours when they are covered by the tide. When the tide is out, birds such as gulls and oystercatchers search the shore probing amongst the seaweeds for small animals.

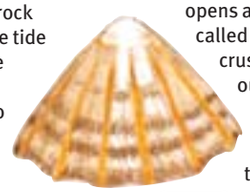


▲ The top of the edible crab's shell, called a carapace, is shaped just like the pastry lid of a pie. The adult crabs can grow to more than 15cm across the shell, and they live in deep water. The baby crabs may be found in rock pools, hunting prawns and other small animals. They are also scavengers, eating the remains of any dead animals they find.

Here are some of the more common types of animals you can expect to find on the rocky shore:-

Limpet Lifestyle – The limpet is perhaps the most well-adapted of all the marine snails for a life on the exposed rock surfaces. Each limpet has its own 'home' – an exact spot on the rock where it stays when the tide is out. On soft rock, the limpet grinds the surface with its shell to make an exact fit; on hard rock, the shell is ground down to fit the rock's shape. This tight fit allows the limpet to trap a spoonful of water inside to prevent it drying out. A strong foot muscle gets a firm grip on the rock, making it difficult for birds to prise off the limpet.

When the tide covers their rock, or in wet, cool weather, the limpets leave their base and wander about, grazing on young seaweeds which have started growing on the rock surface. Before the tide goes out, each limpet returns to its own 'home'.



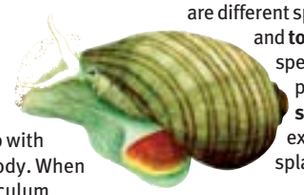
▲ Limpet

Crusty Barnacles and **Dangerous Dogs** – The rocks of the upper shore are often covered in barnacles, particularly the **acorn barnacle**. These crustaceans start life as tiny larvae floating in the sea with the plankton, and most come to rest in the intertidal area of a rocky shore, cementing themselves firmly to the rock. When exposed to the air, the barnacle closes its opening with a hinged trapdoor-like **operculum** – this is made of two limy plates which join up with other plates to protect the body. When covered by the sea, the operculum opens and six pairs of feathery legs called **cirri** (the equivalent of other crustaceans' legs) appear and filter out particles of food.

The barnacle thrives best in exposed conditions high up on the shore, but even here it is not safe from predators. It is the favourite prey of a carnivorous mollusc, the **dog whelk**, which wanders up from the middle shore to attack the barnacles. The whelk also attacks other molluscs, particularly the limpet, by either producing a shell-dissolving acid that makes a hole in the shell, or by boring a hole through the shell using its rough, belt-like tongue. The flesh is then sucked out. If you find an empty limpet shell with a small, neat hole in it, this is the work of the dog whelk. The dog whelk itself may be attacked by crabs and herring gulls.

More Molluscs – As well as the limpets and the dog whelks, several other molluscs live in the intertidal zone. Molluscs of the rocky shore are mostly **gastropods** which are the snails with one shell, whilst those on the sandy shore are mostly **bivalves**, the molluscs with two shells, such as cockles. The bivalves can burrow down into the sand for safety, but the gastropods, being unable to burrow into rock, have strong shells with an operculum (trapdoor attached to the foot muscle).

The gastropods found on the rocky shore are different species of **periwinkles** and **topshells**. Each species lives in a particular zone; the **small periwinkle**, for example, lives in the splash zone and is almost a land animal, being able to breathe air. However, the females have to release their eggs into the sea at high tides so that the larvae can live amongst the plankton.



▲ You can tell what a dog whelk eats by the colour of its shell. Pale-coloured dog whelks have eaten barnacles, and dog-coloured whelks have eaten mussels. The one pictured here has a banded shell that may mean that it has a varied diet.

At low tide, other periwinkles and the topshells may be found stuck to the rocks by their sucker-like foot, but when the tide covers them, they creep slowly about, grazing on young seaweeds.

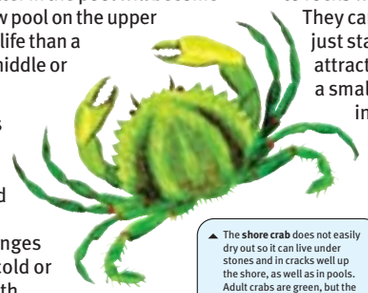
▲ Rough Periwinkle

Life in a Rock Pool

A rock pool is like an attractive sea aquarium, an oasis at low tide for many animals and seaweeds. The life within them is always submerged whatever the tide is like but there are problems for the residents of a rock pool, particularly a shallow one.

On a hot day, the sun will evaporate the surface water, making the water saltier than usual. When it rains the water in the pool will become diluted. So a shallow pool on the upper shore will have less life than a deeper one on the middle or lower shore.

The best rock pools for wildlife are those low down on the shore, large and deep enough to prevent drastic changes in temperature on cold or hot days, ideally with overhanging areas and dark crannies. Such a pool will probably be full of life, although not all of it will be easily visible. A smaller pool is easier to investigate. If you watch quietly by the side of a shallow pool, the first obvious signs of life will be the seaweeds, some pink ones encrusting the rocks, others attached to the rocks, swaying in the water. Wait patiently and you may see fish, prawns, crabs and other creatures acting out their lives in front of your eyes.



▲ The **shore crab** does not easily dry out so it can live under stones and in cracks well up the shore, as well as in pools. Adult crabs are green, but the young can be red or yellow with white patches. The crabs feed on small animals, dead or alive.

The anemones stick themselves to rocks with a slimy disc. They can move around a little but usually just stay put, waving their tentacles to attract small fish or crustaceans. When a small animal is seized and enfolded in the tentacles, stinging cells paralyse the prey and it is swept into the mouth to be digested by special juices.

The crustaceans you are most likely to come across in a rock pool are the shore crab, hermit crab and common prawn.

Unlike the familiar cooked prawn, a live prawn is not pink! The **common prawn** is a transparent greyish colour with coloured dots and lines visible inside. It has very long antennae and lives in rock pools on the lower shore, scavenging for bits of seaweed and dead creatures, as well as capturing small live prey.

▲ The common hermit crab is well known for its habit of living in empty mollusc shells. The smaller crabs live in the rock pools on the lower shore and the larger ones are found further out in deeper water. Unlike other crabs, the hermit crab does not have a carapace but has a soft, unprotected abdomen which it hides away in an empty periwinkle or whelk shell. As it grows, the crab has to pop out of its shell and moult its hard outer skin, and then quickly find a bigger shell to move into before a predator spots it! The crab walks slowly around the bottom of a pool scavenging for any dead plant or animal remains.

The beautiful **sea anemones** are seen at their best in the deeper pools. Anemones are related to jellyfish and corals – all simple, aquatic animals belonging to a group known as **Cnidaria**, a word which comes from the ancient Greek meaning "nettle". Cnidarians have tentacles around their mouths that can sting like the leaves of a nettle.

▲ The beadlet anemone is the most common anemone. It is usually a deep red colour with purple blotches marking the positions of the stinging cells. It may be found on the upper shore, left high and dry at low tide, looking like a blob of red jelly, its mouth cavity firmly closed, with the tentacles tucked inside. This helps it to retain moisture while waiting for the next high tide.

The only vertebrate animals you are likely to come across living in a rock pool are a few species of **fish**. Rock pool fish may be permanent residents or just visitors stranded by the tide.

The fish you are most likely to come across from the upper shore downwards is the **common blenny** or **shanny**. It has no scales but its body is protected by a thick layer of soft slime which helps it to slide amongst sharp rocks, and also helps to stop it drying out if stranded between tides on a drying beach. Tough little teeth allow the shanny to crack open barnacles and even limpets.

Protecting the Seashore

Seashore Conservation Code – When investigating a seashore it is important to remember that the welfare of the plants and animals must come first.

Treat them with care! If seaweeds are attached to rocks do not try to pull them off, just examine them where they are growing. Handle animals with care and return them to the place where they were found. Anemones and limpets are normally firmly stuck to rocks and any attempt to remove them may result in their death. Replace any large stones that are moved – animals that live on the underside soon die if left exposed.

Pollution Problems

Seas and seashores are under continual threat from pollution. Here are a few examples :-

Oil spills – either accidental or deliberate (it is estimated that around 72% of oil pollution is deliberate and illegal), have a devastating effect on marine life, especially seabirds. Large amounts of black tar-like oil washed up on a rocky shore are likely to completely destroy the entire community of living things. Chemicals used to disperse oil spills on a shore may clean up the oil but they can also cleanse the shore of life! The best policy for marine life is to physically remove as much oil as possible and leave the rest to break down naturally. A rocky shore will recover much more quickly if chemicals are not used.

Sewage and litter – also upset seashore ecosystems, making them unsightly and perhaps contaminated with chemicals. Some litter can be dangerous to wildlife – and humans!

Toxic chemicals and radioactive waste – a cocktail of toxic chemicals have found their way into the sea over the years, affecting both marine and human life. For many years, potentially deadly radioactive waste from nuclear power stations and other sources was disposed of in the sea, and beaches have been contaminated by accidental leakages from nuclear power stations.

Investigate... Pick a Project!

Choose one of the mentioned sources of pollution and find out as much as you can about it. What problems are caused by the pollutants? Who, if anyone, is responsible for cleaning up the pollution? Can you suggest what can be done to stop the pollution happening in the first place?

Holidaymakers make a big impact on beaches all over the world. Find out how tourism can affect ecosystems. Can anything be done to reduce the problems?

Useful Web Sites

Marine Conservation Society
www.mcsuk.org
Charity dedicated to the protection of the marine environment and its wildlife. Provides educational resources.

Surfers Against Sewage (SAS)
www.sas.org.uk
Organisation which campaigns for a clean, safe, pollution-free coastline.

The National Trust
www.nationaltrust.org.uk/coastline
The National Trust's educational resources concerning the protection of Britain's coastline.

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Young People's Trust for the Environment
Suite 29 Yeovil Innovation Centre, Barracks Close, Copse Road, Yeovil, Somerset, BA22 8RN
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