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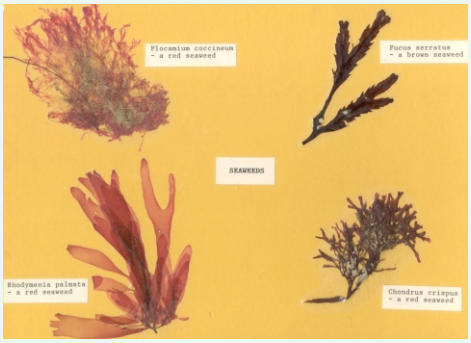
THE SEASHORE BZ 3

Three Seaweed Sample Cards



Seaweeds are simple plants. They have neither roots, stems or leaves and they do not produce flowers. They are classified into three groups green seaweeds, brown seaweeds and red seaweeds. Floating in the clear water of rock pools they can be very beautiful, but when they are pulled from the water they form soggy clumps which soon decay.

Seaweeds have been used as a food for both humans and animals. In the nineteenth century several seaweed species were harvested, dried and burned to make soda ash. This was used in soapmaking, glassmaking, and other industries. It was also used as fertiliser for farm land. Alginic acid, a sticky gum found in brown seaweeds, is used to thicken products such as ice cream, jelly, salad dressing and toothpaste.



Up until the mid-ninteenth century seaweeds were little noticed by anyone but botanists who specialised in studying algae. However, in 1863 Mrs Margaret Gatty (left) published her two volume *History of British Seaweeds*. Although this was a scholarly work it stimulated interest in seaweeds. This was a period when collecting (or sketching) from nature - everything from ferns to eggs, mosses to shells - became widespread among the non-scientific public. This fashion was encouraged by books which argued that the natural world reflected the love and glory of God. Mrs Gatty herself wrote several popular texts with this theme, in particular *Parables from Nature* (1855), which was a mid-Victorian bestseller.



The two cards with examples of seaweed mounted on blue card were made to cater for this fashionable hobby and probably date from the second half of the nineteenth century. They have been carefully labelled. They were professionally made, rather than collected by a lady amateur. People living on the coast soon realised that there was money to be made by selling seaside curios to members of the public who wanted to increase the size of their seaweed collection.

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Sponge



Sponges are one of the most primitive animals - so primitive they were once thought to be plants! They lack internal organs, nervous tissue, a circulatory system or a gut. To obtain food, sponges pump water through their bodies to filter out tiny nutritious particles. To support and protect their soft bodies, sponges produce skeletons of calcium carbonate, silica or a soft organic material called spongin.



There are over 200 species of sponge in the sea around Britain. The photograph on the left shows one of them, *Leuconia nivea* , which is common beneath boulders on the low shore.



The remains in this box are of a species known as elephant's hide sponge (*Pachymatisma johnstonia)*. A photograph of a living example can be seen on the right. This sponge may reach 40 cm in diameter and 10 cm in height. It has a firm rubbery consistency. It attaches itself to rocks, in shallow waters to depths up to 300 metres, in the English Channel, the Atlantic ocean from the North of the British Isles down to Spain and in the Mediterranean Sea.

Sea Mat



At first sight a sea mat looks like a piece of seaweed. It is, in fact, a colony of thousands of tiny creatures. Sea mats belong to a category of animals called bryozoa.

Sea mat colonies range from millimetres to metres in size, though the individuals that make up the colonies are usually less than a millimetre long. In each colony, different individuals do different jobs. Some individuals gather up the food for the colony, others strengthen the colony and some act as cleaners of the colony. If a piece of a bryozoan colony breaks off, the piece can continue to grow and will form a new colony. Like sponges, they feed by sucking in water and extracting microorganisms.

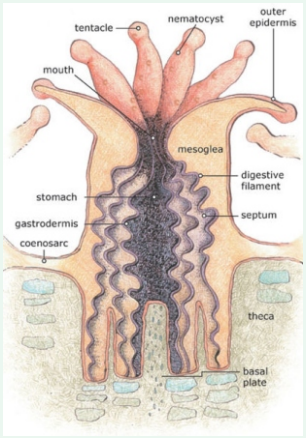


This species is called hornwrack (*Flustra foliacea*). A photograph of a living example can be seen on the left. It is common throughout the British Isles.

Staghorn Coral



Corals, like sea mats, are colonies made from thousands of individuals, each of which is only a few millimetres in diameter. A diagram of a typical, but much magnified, individual can be seen below left. Each polyp looks like a tiny sea anemone. The individual animals which make up the colony are usually referred to as a polyps. The colony acts as if it was a single organism. It gradually gets bigger as each generation grows on the skeleton-like remains of previous generations. Each species has a distinctive shape.



The specimens in this box consist of the calcium carbonate core which is built up over time. Living corals are often very colourful. This is because the individual polyps contain algae which give them their colour.

Staghorn coral (*Acropora cervicornis*) is a branching coral with cylindrical stems ranging from a few centimetres to over two metres in length and height. This coral grows quickly, with branches increasing in length by 10-20 cm a year.



Staghorn coral is designed to be broken. New colonies form when branches break off and re-attach themselves to the sea floor. This habit allows population recovery after storms. Unfortunately, since 1980 populations have collapsed as a result of disease, hurricanes, bleaching (caused by rising water temperatures) and other factors. The photograph on the right shows living staghorn coral off the coast of Florida.



Corals live in the seas around Britain. In the UK the commonest species of coral is *Lophelia pertusa* (left), which has been found in small colonies from north of the Shetlands, to the far west of Rockall.

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Worm Tubes

The white, curled tubes on this seaweed frond were made by a tiny worm with the Latin name *Spirorbis borealis*.



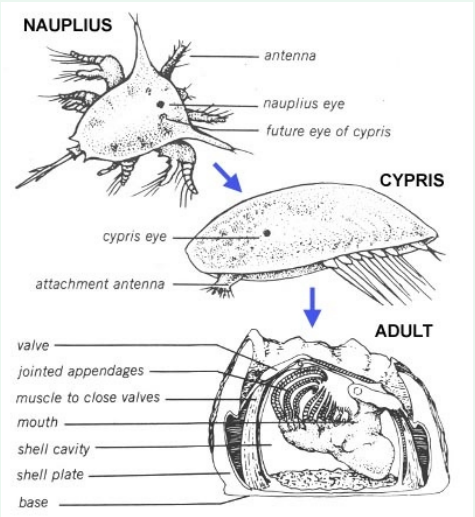


These miniscule creatures make a hard protective tube from out of which they extend green tentacles to collect particles of food. Such tubes are also sometimes found on rocks and stones. *Spirorbis borealis* is common around the coasts of Britain.

Acorn Barnacles on Pebble



At first sight people think barnacles are molluscs - that is, that they are similar to winkles, limpets, whelks and other sea creatures that have a shell. In fact barnacles are crustaceans and are more closely related to crabs and lobsters.



Barnacles have a three-part life cycle (left). They start out as a free-swimming larva, called a *nauplius*. The *nauplius* grows a pair of shells around its body and becomes a *cypris* larva. The cypris larva attaches itself permanently to a rock or any other hard structure. The larva now begins to create hard plates that end up completely surrounding its body. For the rest of their lives they are cemented to the ground.

A barnacle feeds by opening its shell and unfolding its feathery legs (called *cirri*). The cirri sweep tiny particles of food suspended in the water into the barnacle's mouth (below). When the tide falls, the plates close to prevent the barnacle from drying out.

These barnacles are called acorn barnacles (*Semibalanus balanoides)*, a very common species around the coast of Britain. Adults of this species may live up to seven years. Predators of the acorn barnacle include whelks and starfish.



Large Tropical Barnacles



These barnacles come from the tropics, where the temperature is higher and food more abundant. Because of this, species from these regions are larger than those that live in British waters. The plates which protect the creature within can be clearly seen - there are six in this species.



It is not known where this sample was collected from. It may consist of specimens of the titan acorn barnacle (*Megabalanus coccopoma*), which is native to the eastern Pacific Ocean. A similar species, *Megabalanus rosa*, lives on the west coast of the Pacific, in Japanese waters. A photograph of titan acorn barnacles, which grow to about 5 cm in height, can be seen on the left. They have recently spread into the seas off the east coast of the USA.

Pea Crab



The pea crab (*Pinnotheres pisum*) is a small crab that lives in mussel shells. They have a large tail flap that is used to cover eggs under the body when they are breeding, adding to their spherical appearance. Four pairs of legs and nippers are visible, as with most crabs. They are found from southern Scandinavia to western Africa.



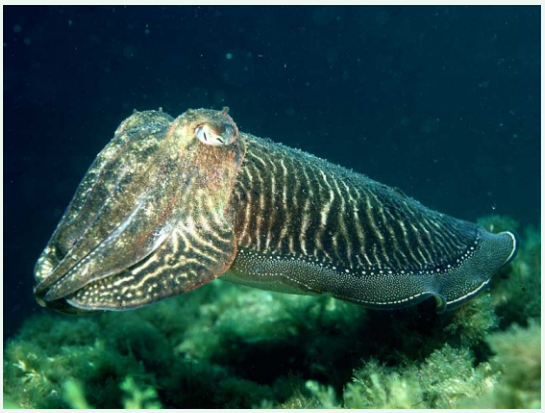
These crabs are ***not*** the same as the more familiar hermit crabs, that live inside empty discarded shells. Pea crabs live inside mussel shells that contain a living animal. The brown male pea crab is an active swimmer and is often seen hanging around mussel beds. The female (left), however, is quite different. She is almost twice the size of the male and usually yellow with a bright red blob on her soft shell. She is hardly able to crawl and cannot swim. She does not need to because she spends her whole life inside a live mussel shell. The male fertilises her eggs by swimming inside the mussel when it opens to feed.

It was once thought that pea crabs were not harmful to their hosts, but some researchers now suggest that their activities do cause some damage to the delicate gills of their mussel hosts and that these crabs should be considered parasites.

Cuttlefish 'bone'

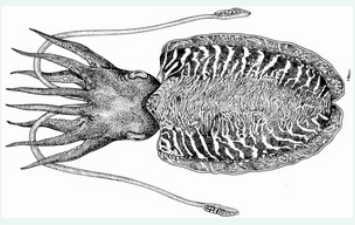


Cuttlefish 'bones' are often found on the beach, but many people do not know what the living creature actually looks *like* - a photograph of the common cuttlefish (*Sepia officinalis*) can be seen below left. Cuttlefish, despite their name, are not fish, but molluscs. Most molluscs have external shells - clams, oysters, mussels and so on - but some have evolved so that the shell has become internal, or disappeared altogether. Squids, octopuses and cuttlefish are all molluscs that have lost their hard outer shell.



Cuttlefish have large eyes, green-blue blood, eight arms and two tentacles, with which they secure their prey. They move by jet propulsion - suddenly squirting out water from their breathing cavity. They eat small molluscs, crabs, shrimp, fish and other cuttlefish. Their predators include dolphins, sharks, fish, seals and other cuttlefish. They live about 1 to 2 years. Some studies have suggested that cuttlefish are among the most intelligent invertebrate species (animals without a backbone). In the UK, cuttlefish are found mainly on southern and western coasts of Britain (right).





Cuttlebones are made of calcium carbonate and help to keep the cuttlefish buoyant. Buoyancy is controlled by changing the gas-to-liquid ratio in the chambers of the cuttlebone. Each species has a distinct shape, size and pattern of ridges or texture on the 'bone'. After they die, their flesh rots away leaving this strange, bleached-white object. Cuttlebones are traditionally used by jewelers and silversmiths as moulds for casting small objects and are commonly used as calcium-rich dietary supplements for caged birds.

Three Limpets

Limpets are gastropods (they have a single shell), while other shelled creatures are bivalves (they have two shells). Limpets live on rocks and eat seaweed.

Common Limpet (*Patella vulgata*)



The common limpet is abundant on rocky shores exposed to the waves, but is less common on shores with a dense growth of seaweed. They feed by grazing on algae found on rock surfaces. They scrape films of algae from the rock with a ribbon-like tongue with rows of teeth.

Limpets resist drying out when the tide recedes by grinding their shell into the rock and clamping down with their strong muscular foot until the tide comes in again. They are territorial and return to the home scar by following the trail of mucus they left as they went foraging when the tide was in. It is unclear how limpets find their way back to the same spot each time, but they may follow a mucus trail left as they move. Shells higher up on the shore tend to have taller shells than those on the lower shore. The underside of the muscular foot on which the limpet moves around is yellow, orange or brown. They change sex at 4 years old, becoming female, and can live up to 17 years when environmental conditions lead to slow growth.



Black-Footed Limpet (*Patella depressa*)

This limpet has a flatter shell than the common limpet. It lives on exposed, wave-beaten rocky shores from the middle to the lower shore. It is a southern species and is found mainly on the south and west coasts of the British Isles.

American Slipper Limpet *(Crepidula fornicata)*



This is an American species which has been introduced into British waters. Its first known occurrence in Europe was in 1872 in Liverpool Bay. By the end of the twentieth century it was present all the way round the coast from Spurn Head to Cardigan Bay. Its success is probably due to a lack of predators and its unusual method of reproduction which relies upon individuals settling upon each other. Slipper limpets are commonly found in curved chains of up to 12 animals. Large shells are found at the bottom of the chain, with the shells becoming progressively smaller towards the top.

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Top Shell

Top shells are common shells, often brightly coloured with darker bands. They graze on rocky surfaces, feeding on algae. This specimen is called the flat top shell (*Gibbula umbilicalis*) and is found on western shores of the UK as far north as Scotland.





Common Screw Shell

This animal, called in Latin *Turritella communis*, has a number of English names, including turret shell and tower shell. It is common around Britain, but is absent from the south east coast of England. It is abundant on muddy gravels in shallow water and feeds on particles floating in the water.

Common Winkle



The common winkle (*Littorina littorea*) is also known as the edible winkle, as it has long been gathered from the shore for food. It is found on both rocky coasts and muddy habitats. It can be found in both saltwater and brackish water. Like its land relation, the snail, the winkle moves on a muscular, fleshy foot lubricated by a film of mucus. When not walking, it often nestles in a crack or gully and seals the gap between its shell and the rock with mucus.



Flat Periwinkle

The flat periwinkle (*Littorina littoralis*) is very common on British beaches with brown seaweeds. The colour of the shell varies widely, most commonly being brown or yellow, but it can be white, green or even banded. The shell colour is dependent on the habitat, with lighter shells being found in more sheltered shores. This specimen has a yellow shell.



Whelks

Whelks are carnivorous animals that hunt other molluscs.

Whelk Egg Cases



These are the egg cases of the common whelk (*Buccinum undatum* - below left). Empty egg masses, known as 'sea wash balls', are often found on the shoreline and are sometimes mistaken for sponges.

The common whelk preys on a variety of mussels, tubeworms, and even other dog whelks. It either bores a hole in the shell of its victim, or prises open its lips to get at the soft flesh. When a hole has been formed paralysing chemicals and digestive enzymes are squirted inside the shell to break the soft body down into a mush which can be sucked out with the whelk's proboscis.

Whelks attack a mussel by waiting in front of it until it opens its shell. The whelk pushes a tube shaped organ called a sipho between the shell halves and prevents the mussel from closing. Afterwards a snout with a rasping tongue (called a radula) follows the sipho. With its long sharp dagger-shaped toothlets the whelk rips pieces of flesh from the mussel's body. Sometimes the mussel tries to stay closed until the whelk moves on. Unfortunately mussels cannot breathe with their shell halves closed. Eventually they have to open their shell in order not to suffocate. It takes about a day for a whelk to eat a barnacle, although larger animals such as mussels may take up to a week to digest.



Whelks, in turn, are eaten by a number of other animals, including various species of crabs and birds - and they are also popular with humans. Many predators cannot smash the strong shell of an adult dog whelk, but young whelks are vulnerable to attack. Eider ducks and various other birds simply swallow the entire body with its shell, while oystercatchers and various lobsters are often capable of crushing or breaking the shells. In general, the common whelk can be thought of as being vulnerable to birds when out of the water and to crabs when in the water.

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Netted Dog Whelk

The netted dog whelk (*Nassarius reticulatus*) has a thick, pointed shell with a network of ridges and grooves. It prefers to live in a sandy habitat. It is widely distributed and common around the coast of Britain.





Dog Whelk

The dog whelk (*Nucella lapillus*) is a predator of barnacles. It has a short coned shell, with flat spiral ridges. Its shell is highly variable in appearance, depending on wave exposure and location. Dog whelks often spawn in groups - the photograph on the left shows such a group under a rock with their eggs. The number of eggs per female ranges between 100 and 1000. Eggs are laid in protective cases in cracks and crevices on hard surfaces.

Tiger Cowry

Cowry shells are found chiefly in tropical regions. The shell itself is almost always smooth and more or less egg-shaped, with a long, narrow, slit-like opening. Most varieties have a porcelain-like shine and many have colourful patterns.



The tiger cowry (*Cypraea tigris*) is probably the best known of all the cowries and the most variable in size, shape and colour. It is found throughout the Indian and Pacific Oceans. It can be seen under rocks or resting on soft corals during the day and foraging for food at night.



European Cowry

The European cowry (*Trivia monacha* - specimen number 23) is much smaller than its tropical cousin. This species feeds on sea squirts. Females also use sea squirts as nesting chambers, biting holes in the colonies and then laying their flask-shaped egg capsules (each containing around 800 eggs) into the hole. There is one other species of cowry found around Britain, which is even smaller than this species.

Great Scallop (Pecten maximus)



The great scallop (*Pecten maximus*) is unusual in that its two shells are not symmetrical, one of them being flat and the other curved. Only a flat shell is included in this box. Great scallops spend most of the time resting on the curved shell in depressions on the sea bottom, so that the flat shell is parallel to the sea-floor. Sand, mud, gravel or weeds cover the upper shell so that only the opening between the shells remains visible. The scallop's tentacles and eyes protrude between the two shells - see the photograph below left. It feeds by filtering particles from the surrounding water.



Although they spend most of the time sitting still, great scallops can swim by rapidly clapping their two shells together and expelling water. They tend to do this if threatened, though their preferred strategy is to hide in the sand and stones of the sea bed. Scallops reach sexual maturity after several years and may live up to 18 years, with their age reflected in the concentric rings of their shells. Scallops are a popular seafood and in some places have been over-exploited.

Common Mussel

This familiar animal occurs in huge numbers around the coast of Britain. It anchors itself firmly to the rocks by a tough thread called a byssus. This anchor is strong enough to resist a forcible pull, but is attached loosely enough to allow the mussel to swing round to meet the thrust of the moving sea waters with its narrower end. It feeds on plankton and other microscopic sea creatures syphoning water through its body.



The common mussel (*Mytilus edulis*) usually lives in the area between high and low tide, where it can form extensive beds dominating the rock surface. If need be, it can live high on the shore because it is tolerant of desiccation and frost. It is, however, eaten by starfish, dog whelks, shore crabs and various birds. Mussels on exposed coasts are often free of predators, while those in sheltered waters may suffer extreme predation. It is often harvested, cooked and eaten by humans too.

Common European Edible Cockle



This well-known edible cockle (Cerastoderma edule) has two shells with prominent ribs and growth-lines. They live on the middle and lower shore, where they burrow into soft sand, mud and muddy gravel to depths of less than 5cm. They are often found in huge numbers in estuaries and other sheltered inlets.

The common cockle eats material floating in the water. The sexes are separate, and adults typically begin to spawn in their second summer. Growth rates vary with the season - in winter there is very little growth. The typical life-span of this cockle is 2-4 years, although they may live for 9 years or more.

Cockles are preyed on by oystercatchers, crabs, shrimps and flatfish. They are also popular as a food with humans and have been collected and sold for hundreds of years. Mechanised forms of collecting, using tractors and hydraulic dredging, have led to serious population declines.

Portuguese Oyster



The Portuguese oyster (*Crassostrea angulata*) is not a native species, but it has been introduced into commercial oyster farms in British waters and colonies can survive for several years. It was first introduced from Portugal in 1926. It is found in scattered southern areas and population groups have been known to disappear after flourishing for a short while. The Portuguese oyster spawns (produces eggs) at water temperatures of 18.5° to 24° centigrade and this seems to be the main reason for their limited success around the coast of Britain. It is possible that if sea water temperatures rise, then their numbers will increase.

Razor Shell



Razor shells (*Ensis siliqua*) are common around the coast of Britain. The living creature, though, is less commonly seen. They live in sand, lying buried with only a siphon protruding. The siphon is used to suck in currents of water from which they extract oxygen and food. Even the siphon is rarely seen, as razor shells are sensitive to vibrations and light and will rapidly retreat into their burrow before it is possible to get close. Maturity is reached after three years and breeding takes place during spring. The life span of the razor shell is thought to be around 10 years.

The Banded Wedge Shell



The banded wedge shell (*Donax vittatus*) has a thin broad shell which may reach 3 cm in length. The shell is decorated with bands of colour and can be yellow, orange, pink or brown. The edge of the shell has minute teeth to seal the shell from predators where the valves meet when closed. It is mainly found on exposed sandy beaches and can quickly re-bury itself with its powerful foot if it is washed out by waves. The banded wedge shell is preyed upon by many of the carnivorous molluscs, starfish and flounders which inhabit sandy shores.

Pink Conch



At least 65 species of conch are known to exist. Most live in the Indo-Pacific Oceans, while a few are found in the western Pacific and the Caribbean region. They are all herbivores (plant eaters), living mostly in shallow, sandy areas. Conches have long eye stalks (see the photograph below left, which shows the protruding eyes of another conch, *Strombus alatus*) and are active browsers in the shallow waters around coral reefs. Conches have a characteristic leaping motion when they move. They lay eggs in long, gelatinous strands.



The pink conch (*Strombus gigas*) is also known as the queen conch. It lives in the Caribbean. It is edible and forms an important part of the diet in many islands in the West Indies. The demand for its meat and for its attractive shell has led to a decline in numbers.

Sea Urchin





Living sea urchins (left) are covered with spines, but these usually decay quickly after death leaving a shell. A sea urchin has no visible eyes, legs or means of propulsion, but it can move freely over surfaces by means of its adhesive tube feet, working in cooperation with its spines. The mouth is found on the lower surface. Sea urchins eat plant and animal matter, including sea weed, decaying matter, algae, dead fish, sponges, mussels and barnacles. The mouth is connected by a gut to the anus on the upper surface. Sea urchins do not have a brain.

Flat Sea Urchin



This kind of sea urchin is not found in this country. In the USA such creatures are referred to as sand dollars and sea biscuits. They differ from sea urchins in that their spines are tiny, more like a covering of velvety- hair, and the underside is usually flat or concave with the mouth directly in the centre and the anus to one side - as can be seen on this example.

Sand dollars live just beneath the surface of sandy or muddy areas. The spines on the underside allow it to burrow or to slowly creep through the sand. Their tube feet move food - plankton and plant fragments - to the mouth opening. In America children are sometimes told that sand dollars are the money of mermaids washed-up from the deep.

Lesser Spotted Dogfish Egg Case



The lesser spotted dog fish (*Scyliorhinus canicula*) is a member of the shark family. It is very common in the seas around Britain. It is nocturnal and feeds on molluscs, crustaceans, worms and small bony fishes.



Dogfish numbers are high because of its prolific breeding behaviour - two eggs are laid every 5/6 days during the breeding season between November and July. After 5-11 months (according to water temperature) the young hatch and are able to feed straight away on dead or small prey items. They grow to a length of 2-3 feet (60-100 cm). A living egg can be seen on the left. These egg cases are sometimes called mermaid's purses. Dogfish meat is sold as 'Rock Salmon' - a term which was concocted because it was thought that the name dogfish would not appeal to consumers.



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Skate Egg Case



The common skate (*Dipturus batis* - below left) is a huge fish. Males grow up to 2 metres in length, while females may reach up to 3 metres. It has a long, pointed snout and large ray-like fins. However, the most common skate in British seas is the thornback ray, (*Raja clavata)*. Both species have been fished to the point of extinction and have been assessed as Critically Endangered by the World Conservation Union.



Part of the reason for their decline is that they are long lived fish and take many years to become able to breed. Males only attain sexual maturity once they have reached a length of 125 cm, which happens at around 10 years of age. They are thought to be able to live for as long as 50 years and it takes around 14 years for the population to double in size. Mating occurs mainly in the spring and the female then lays long oblong egg capsules, which are anchored into the muddy or sandy sea floor by their stiff pointed horns. An individual will lay around 40 eggs a year.

Half Cod Jaw



Cod can grow to be large adults. They grow quickly and can reach a length of 20 cm after one year, 50 cm after two years and 80 cm by the time they are four years old. Surveys in the late twentieth century have recovered fish between 130 and 140 cm long. In the past even larger specimens were probably to be found.

Cod inhabit relatively shallow waters (30 metres or less) but migrate towards warmer, shallower waters to spawn during the winter and early spring. Sexual maturity is attained between the ages of two and four. Huge numbers are released during spawning because only a few will survive and develop into adults. As fish grow larger their ability to produce eggs grows: a 100 cm female may produce about 3 million eggs and a 125 cm female up to 9 million eggs in a season. It has been calculated that if each female cod produces just two young that live to be adults then the population would be stable. Unfortunately cod stocks have catastrophically declined in the course of the twentieth century.

Despite the sharp appearance of its teeth, the cod will eat practically anything it finds on the seabed. In the past, mermaids are supposed to have used half a cod jaw as a comb!

Pipefish



Pipefish are small fish, which with the seahorses form a family called *Syngnathidae*. There are about 200 species of pipefish, most of which are poor swimmers. They have a much reduced tail fin. The largest of the pipefishes is the snake pipefish (*Entelurus aequoreus)*, which is common around Britain. Females grow up to 60 cm and males up to 40 cm. The photograph below shows a snake pipefish being taken by an otter. Unfortunately, their rigid, bony structure makes them difficult for young seabirds to swallow and there are numerous records of chicks choking to death.



Seahorse





Seahorses, like pipefish, are weak swimmers. They use their tail to anchor themselves on weeds. There are two species which are found around Britain - the spiny seahorse (*Hippocampus guttulatus*. Left), which can be found as far north as the Shetlands, and the short snouted seahorse (*Hippocampus hippocampus*), which is confined to the southern coast. They feed on tiny shrimps.

Seahorses are very unusual in that the male gives birth to the young and takes all responsibility for parental care. The female deposits her eggs into a special brood pouch on the male. He then fertilises them and carries them for a month before giving birth to up to a thousand tiny babies.