

Bugs Came First – notes and explanations

Bugs Came First is meant as a resource for schools and groups to use and make their own – feel free to adapt, add to it, or re-write your own version

For teachers - background to the project

Footloose worked on the pilot version of this piece with children from Years 5 and 6 at St. Mary's School, Bucknell.

The Story

The story begins with badgers, frogs and a hedgehog discussing with each other how their world is changing, but not in a way they like or that feels good. They decide to go and ask their neighbour, Owl, for advice. The hedgehog and frogs are careful to keep a distance, as owls sometimes eat them (and hedgehogs have been known to eat frogs..) But these are not normal times, and so after a short discussion they decide to call a General Assembly, where animals from all over the world as well as the UK can get together to tell their stories and discuss what to do.

Owl sends out messengers, and animals gather from far and wide for the Assembly. This is an opportunity to put in lots of extra animals who do not have to sing solo or do much except sit and make background noises and wave feelers, wings etc.

Owl facilitates. Animals tell different stories about how their world is changing, with forests being cut down, food running out, land and sea being poisoned and animals getting strange diseases. They agree that it is because of the Terrible Thing, which is taking over the world, and is something to do with humans although humans have (or seem to have) no control over it.

Owl says her great-great-great-great-granny told of a prophecy, that one day the earth and all that lived on it would be in great danger, but that some children, with the help of the animals, would save the world. Swallow is sent to find these children, and lead them to the Old Woman of the Woods who will help them.

The Old Woman tells the children that they first have to go to the ocean and find out about the Plasticsaurus – the plastic monster that lives in the North Pacific – this monster represents the Great Pacific Garbage Patch. And of course, the monster only exists because of what is happening on land, where people are throwing out their plastic rubbish. The Old Woman gives the children a special golden fruit to use if they are in danger, and tells them that the Terrible Thing cannot stand laughter or music.

After a journey over and under the sea, accompanied by improvised music, and meeting lots of sea creatures (represented by projections and images waved on sticks) the children find the monster, who is lamenting bitterly, and says it doesn't want to exist and only does so because the Terrible Thing feeds it. The monster tells the children that they must go back to the land and find Trash Unlimited at No.1 Misery Street, and get rid of the Terrible Thing that is destroying the world. Only after this can the monster – and all the rest of the world - be set free.

The children get a lift on the back of an albatross as far as the shore, and then with a peregrine falcon who takes them to Misery Street but then has to leave. Outside No 1 there are guards who

forbid the children to go any further. But the children overcome the guards easily by singing and laughing. As they hold up the golden fruit, trees and plants spring up, the Terrible Thing dissolves and the world and its animals (and all the other life forms) are free again.

How we did it

The music and songs were all written first. Subsequently we added the movement, and made masks to depict different animals.

We spent our first sessions talking about biodiversity, playing games, experimenting with improvised sound, and learning songs. After that we decided together who would be which animal and worked out the movements.

Then we worked on the performance as a whole, learning songs and movements by heart, making the masks, and creating sound effects.

The chorus songs are for everyone to learn: Metal Monsters, It's the Thing, Creatures of the Planet, Come Outside, The Web of Life, and We are Free. The other songs are solos or duos. The piece will still make sense if you miss out some animals and their songs.

For the performance we had a band of four professional musicians: oboe, cello, flute and piano, and a group of children formed a small percussion band. We also used some recorded sound effects, such as birdsong, sea and river sounds, and a series of projections that formed a backdrop. The Owl and the Old Woman of the Woods were played by adults.

The project could be worked on with regular weekly sessions for 6 – 8 weeks, or be concentrated into two weeks with sessions on three - four days in each week. Dress rehearsal needs a full day, and one workshop session should last at least an hour and a half. Mask making takes a full day, and may need extra time in class, or the children can finish them at home if they have the materials.

It is helpful to divide the children into groups with clearly defined music and movement activities for each group. This involves some discipline as one group will have to wait while the others work on a sequence.

The orchestration could vary according to instruments available, but does need a competent pianist, and the cello is helpful.

Games include:

The Web of Life game teaches us about the way all forms of life join up, and how we all need each other to survive. Everybody has a different identity, written on a card – including rain, sun, earth and trees, as well as animals. We are all joined together by a piece of string or wool in the form of a web. One person drops out, and then we find that when that happens, others drop out too – how would we manage, for example, without rain? Some plants will die, animals that eat those plants will die, animals that eat the animals that eat those plants will die....if too many drop out, then the whole web collapses.

The web of life is part of the performance and has a musical theme. At the end of the piece, the spiders spin a web that makes Misery Street dissolve and trees and plants grow again – if we take

care and look after the Web of Life, we can all live happily together sharing the earth with all the other wonderful life forms that exist.

We also did some musical games to help us warm up our voices – eg. breathing in and stretching up to sing as high a note as we can, and then slowly breathing out, bending down and singing the lowest note we can.

We practised a bee hum – everybody humming on a note that is comfortable for them, taking breaths when they need; when enough people are doing it, the hum is easily sustained.

We experimented with finding each other in pairs using signature tunes, like dolphins who find each other in the sea. One person does a short phrase, vocal or percussive, and the other has to find them with eyes shut. When lots of pairs are signalling to each other in the same space this can be quite tricky!

Also we tried making up a group song, with each person doing one short phrase

We did gentle physical warm-ups before we did movement.

Walks

We went for two walks outside with wildlife guides who showed us different plants and animals.

Sound effects and improvisation

We all hummed for the bee sounds.

At the beginning of the sea sound, we wanted the sound of gulls, so everyone collected blades of grass from outside. It has to be quite wide grass. If you hold the grass taut between your two thumbs, and blow, you get a sound very like a herring gull. Then you need to practice the 'chuckle' that these gulls do in between the screaming.

For sound effects, we used some recorded natural sounds – birdsong, a river running, the sea – and also improvised with percussion and our voices. For example, the Asian Tiger entered with huge rolling drums and crashing cymbals to indicate its imperial status. The wolves howled in groups at either end of the hall. These ideas came from the children.

Movement

The movement was essential to bring the piece to life. Some was choreographed to go with the music, and to give a sense of the actual animals portrayed and their characteristics – the jumping spider, the slow-moving Giant Tortoise (a group dance), the industrious ants etc.

Sometimes the children came up with their own ideas in improvisation, and when these worked, they were incorporated into the performance, such as the sequence with the wolves. We tried to strike a balance between allowing the children free use of their imagination and creativity, and keeping the group focused and disciplined.

For the sections where both movement and music are devised through improvisation, it works well

to work out the music first, and then the movement.

We have filmed a few pieces of the movement to give an idea of how it looked in the performance.

Artwork

We spent a day making masks, using cardboard, scraps of material, fake fur, feathers, and anything else suitable. Some children took stuff away and finished their masks at home.

We had fun with wings attached to arms – the butterfly wings, and a pair of huge albatross wings.

Below are some background notes about some animals, both from the UK and the rest of the world. Children may want to do more research into a particular animal, and then be that animal in the Assembly. There are many other interesting UK animals to find out about, like pole cats, or pearl mussels. And there will be specific species that are found in your own area that you may want to concentrate on.

For children - general notes and descriptions of animals

What is biodiversity?

Biodiversity is all the different kinds of life we find in or on the earth, the sea, and in the air.

Life can be as small as tiny bacteria we can't see without a microscope, or as big as an elephant or a whale or an ancient oak tree.

Unlike humans, beetles or daffodils, bacteria are single-celled and so are a different kind of life. 100 grams of garden soil contains 100 billion bacteria. Oceans contain completely different kinds of bacteria, and in 1993 bacteria were discovered living over 2km below the earth's surface. A third of all species are parasites – that's life forms that need something else to live in or on – like mistletoe on apple trees, or fleas on a cat. And nine out of ten animals are insects.

The way life changes over time is called evolution – and it takes place over millions of years. Particular species adapt to suit the kinds of places they live in, for example fish that live at the bottom of the sea don't need eyes because it's too dark to see.

Sometimes one species takes up more room than others, so when it goes, something else can take its place. A species is extinct when there are no more of it left. When dinosaurs roamed the earth, mammals were only very small, like mice or weasels, but when the dinosaurs became extinct there was room for mammals to get bigger, and after billions of years humans appeared. Now humans are taking up more space and not leaving enough room for other animals and plants, although bacteria are as strong as ever.

Not including bacteria, there are about one and a half million species known to science – and the list increases by about 10,000 a year. Only about one in a thousand species that ever existed are still on earth.

An **Ecosystem** is all species and their relationships (how they fit together) in one particular place and time. There are particular conditions (eg hot/cold, or wet/dry, mountain /river bank) that help all

these species to live happily together, and some life forms can only survive in very particular places and conditions.

Everything needs everything else in an ecosystem, so if one species changes or disappears that will affect all the others.

Humans, because we are taking up more and more space, are having a big impact on other species. Our roads cut across other animals' territories, we clear wild spaces to grow food for ourselves, we poison the seas and rivers with plastic, oil and chemicals that kill animals and plants. Carbon dioxide and methane, and other greenhouse gases, emitted when we burn coal, gas or oil, or when we cut down forests, are making the air and the sea much hotter, which affects the delicate balance of ecosystems and destroys many forms of life.

Children – you hold the key to the future. The Old Woman of the Woods sings 'we depend on you' – and this is true. The way we live our lives affects everything else on earth, and all our actions are important – both now and in the future.

There are lots of ways to help keep the delicate threads of the web of life woven together. 'In Bugs Came First', the children are on the side of the animals, and they are brave enough to take the action needed to change the world. And you don't have to travel thousands of miles to do that – you can start right here at home! Make a list of simple things you can do in your own area to help wild animals and plants! If you need help, contact your local wildlife group.

The Richness of Life

In Bugs Came First, we couldn't cover all the different parts of the web of life, and we concentrated on animals. But of course animals are only one part of all the life that exists on earth, and indeed a small one compared to, say, bacteria.

Not all of the following animals have speaking or singing parts in Bugs Came First, and this is only a small selection of all the different species. You may want to add your own favourite animal, get it to attend the General Assembly, or even write a song for it. There's plenty of information you can find in books or on the internet, including some good ones for children, like www.buglife.org.uk

The Animals

Local Animals

Badgers

The badger is a member of the same family as weasels, stoats, martens and otters. Badgers live in setts, a closely interconnected system of tunnels and chambers. Some setts are hundreds of years old, dug out by many generations of badgers, and tunnels may be up to 30 metres long.

Badgers are nocturnal. Their sight and hearing are not so good, but they have an excellent sense of smell – they can smell about 700-800 times more than a human! They also have very sensitive

whiskers above the eyes and around the nose.

Although they don't hibernate, in cold weather they will stay sleeping underground for days at a time, eventually coming out to forage. Their preferred food is earthworms, but they will also eat insects and their larvae, small mammals, carrion, fruits, nuts, cereals, roots, bulbs and tubers. Where food is plentiful, Eurasian badgers often live in large groups of about fifteen, called clans, sharing a home range, or territory – their feeding grounds and one or more setts. Clans will defend their territory together, and a territory may extend for forty-fifty hectares. Where food is less plentiful, badgers live in smaller groups, maybe even just in pairs with their cubs.

The biggest threat to badgers is traffic on busy roads. Like many other wild animals, badgers cannot adapt quickly enough to rapid changes. Generations of badgers follow the same paths, and so if a road cuts across a badger path they will naturally try to cross it. Badgers have been around for many thousands of years, while roads with fast cars on them have only been around for a few decades.

The normal life span of a badger is 12-15 years, but very few survive that long. Although it is illegal, badgers in Britain are also sometimes hunted or trapped, for sport or because they are perceived as a 'pest'. They have been blamed for spreading TB among cattle, though this has still not been proven, and as a result the government allows badgers to be killed in 'disease controlling' programmes.

badgers.org.uk
 beautifulbritain.co.uk
 wildlife-web.org.uk
 savethebadger.com

Frogs and Toads

The difference between frogs and toads is not always clear, but generally, frogs have smooth, moist skin, and longer legs than toads. They are likely to be found in damp habitats, and cannot survive too long without access to some kind of water. The removal of ditches and hedges, and filling in of ponds, has been disastrous for the frog population.

Toads have warty skin, golden eyes and prefer to crawl rather than hop; if threatened a toad can puff itself up to appear bigger. Toads can tolerate drier habitats than frogs and spend less time in water. Frogs jump and toads crawl. They are amphibians, which means they can live both in water and on land.

Frogs and toads are not strictly nocturnal, but can be active during the day, though mainly at dawn and dusk.

In the UK in winter, frogs and toads hibernate in mud in ditches or at the bottom of ponds. They can survive a winter at the bottom of a pond, under thin ice, provided they are in a layer of liquid water, from which they can extract sufficient oxygen to breathe. In the spring they emerge to mate and breed. Toads will generally travel back to the ponds they were spawned in, which may be several miles away – this can be a dangerous time for them if they have to cross roads with busy traffic.

Other threats to these endearing amphibians include drought, water pollution, and the use of pesticides which may poison them, and also means there is less for them to eat. Many are also

suffering from fungal diseases which are spreading rapidly in different countries.

There are many different kinds of frogs and toads all over the world, including transparent glass frogs, brightly coloured tropical poison frogs less than half an inch long, or the Goliath frog from Cameroon which measures nearly a foot long.

The main frog in the UK is the Common Frog, which, sadly, is less common now. Other types of frog have been introduced and some have escaped into the wild, such as the Pool Frog.

Our main toads are the Common toad and the Natterjack.

If you have a garden you can help frogs and toads by building a pond. However small, it will still provide some habitat and a place for eggs to be laid, some of which will successfully turn into tadpoles and then, eventually, tiny froglets and toadlets.

Collective names are 'an army of frogs', and a 'knot of toads'.

allaboutfrogs.org (has lots of good recordings)
froglife.org

Newts

Newts are amphibians, like frogs and toads. In the UK there are Smooth (Common) newts, Palmate newts and Great Crested newts. Great Crested newts are suffering a serious decline.

Newts take three years to reach full size and be ready to mate. Females are bigger than males.

Unlike frogs and toads, female newts lay their eggs individually, carefully wrapped in a leaf of pondweed. Once hatched, the tadpole stays in water until it has developed into a tiny, fully-formed adult newt, and then makes its way on to land, preferably damp vegetation, for the rest of the year.

Newts are nocturnal – they sleep during the day, and in winter they hibernate under stones. In spring they emerge and go back to water to find food. They will eat frogspawn and frog tadpoles.

All newts are protected by law in Britain.

www.arc-trust.org

Hedgehog

Hedgehogs are having a bit of a hard time in the UK, because of loss of habitat such as hedgerows and grassland. Hedgehog numbers have declined by 25% in the last ten years. Fences between gardens stop them moving around, and the use of pesticides has reduced their food supply. Many hedgehogs are killed by cars each year.

Hedgehogs hibernate: they need to weigh about 500 - 600 grams in order to be able to last out the winter. On warm days in early Spring they may venture out and then go back to sleep. In very mild winters they may survive without hibernating, if they are big enough.

Now people are learning to take better care of hedgehogs; there's plenty you can do to help them, if

you have a garden, such as putting out water for them in very hot weather, and making sure there is plenty of dry vegetation, logs etc that can be used for building nests for hibernating in. They must not be enclosed in small spaces though – they can roam for up to about two miles in a night, looking for food.

Hedgehogs are protected under the Wildlife and Countryside Act.

britishhedgehogs.org.uk – British Hedgehog Preservation Society
 hedgehogstreet.org
 ptes.org – People's Trust for Endangered Species

Dormouse (Hazel)

Dormice really do need to sleep a lot. If the weather is too cold, they will just curl up and go to sleep in order to save energy. They also hibernate in the winter.

They are tiny – between 6 – 9 cm long, with a thick furry tail almost as long as their body. Their fur is golden, they have large black eyes, and adults weigh about 20g in the summer, though if they get enough to eat they can weigh up to 35g just before going into hibernation.

They are nocturnal creatures and spend most of their waking hours high among the branches of trees or hedgerows, looking for food. During the summer they will make long detours through the treetops to avoid coming down to ground and exposing themselves to danger. So they need continuous cover, either deciduous woodland or large, overgrown hedgerows in order to move safely from branch to branch. In the winter they need plenty of leaf litter under which they can build safe nests for hibernating. When they wake up in the spring, they weave nests for their young from honeysuckle bark and fresh leaves.

Three to seven blind and furless babies are born in July or August. They grow quickly and leave their mother's nest after about two months. They must weigh about 25 grams before hibernating for the first time, otherwise their chances of surviving the winter are slim. Dormice usually have one litter a year but in a fine long summer they may have two.

Honeysuckle and pollen are their staple foods in spring. In late summer and autumn they eat fruits, hazelnuts, and sweet chestnuts, as well as aphids and other small insects. They also like a certain parasite that grows on oak trees and so they are good for oak trees.

Hazel dormice used to be more widespread in the UK but they are now rare and vulnerable to extinction in this country, mainly because of loss of habitat, especially hedgerows – the UK has lost many miles of hedgerow since World War 2, up to 50% in some areas. Fortunately there are now some established schemes for replanting hedgerows, but some ancient ones have been lost that were unique and irreplaceable ecosystems, and it will take a long time to re-establish sufficient hedgerows to make up for the lost habitat.

Dormice are now mostly found only in the southern counties of England and Wales. Occasionally they may be threatened by owls, weasels and cats, but by far the biggest threat to their survival is the loss of habitat, and starvation in the winter.

If you find empty hazelnut shells with a small round hole in each one, and teeth markings either side, while the inside is smooth with no markings – then probably it has been eaten by a dormouse.

Which is good news, as we need more dormice!

www.dormice.org
www.naturalengland.org.uk
www.ptes.org

Mole

The mole spends almost all its life underground. Moles can dig up to 20m/65ft of tunnel a day with their powerful forepaws. The tunnels trap earthworms and other invertebrates as they fall through the earth. Moles will keep a larder of earthworms for use in hard times, when they are less easy to find.

Moles can be beneficial to humans, preying on many harmful insect larvae such as cockchafers and carrot fly, while their tunnels help drain and aerate heavy soils. Despite this, they are still regarded as a pest by some gardeners and farmers and hunted, even though they do not really cause much damage. However, because they are such strong tunnellers, they can destroy the roots of young plants underground. If you examine a mole hill, you will see how fine the earth is after a mole has been through it – some gardeners use the earth from mole hills for planting seeds.

Moles are active day and night, alternating bursts of energetic tunnelling with rest. They need to eat two thirds of their body weight in a day to keep going. Their tiny eyes register changes in light and dark but they do not see as such. Their noses are extremely sensitive and they have good hearing.

www.ptes.org

Bats

There are 17 species of bats resident in the UK – about a quarter of all UK mammal species. They are the only mammal that can truly fly with flapping wings. There are over 1,100 different bat species worldwide, making up 20% of all mammal species. The smallest bat in the world, the bumblebee bat, weighs only 2 gm. The biggest is the flying fox bat, with a wingspan of 2 metres.

Most, including all British bats, eat insects, but tropical bats will eat fruit, flowers, fish – even blood and other bats! Generally they are very co-operative and share food with each other.

Our most common, and also smallest bat is the Common Pipistrelle. These are the bats you commonly see flying around at dusk, hunting for food. They can eat up to 3,000 insects in a night, mostly caught on the wing. They are tiny, measuring between 3 and 5cm long and weighing about 5 grams - less than a 2p coin.

Bats conserve energy by lowering their body temperature while roosting during the day. UK bats hibernate in the winter. Bats usually only have one baby at a time, though some have two, and can live up to 30 years. In the summer, mothers roost together somewhere warm to have babies. They do not build nests, but hang up or creep into cracks and crannies in hollow trees, caves, houses and custom-built bat boxes.

They navigate superbly in the dark using echo-location. The high sounds they produce are out of the range of normal human hearing, so we have to use bat-detectors, which translate the bats' calls into clicks that we can hear.

UK bats and their roosts are protected by law. Building and construction work pose serious threats to bats –they may die if disturbed during hibernation or nesting time. Although they are not listed as endangered, our bat numbers are definitely declining, mainly because of loss of habitat, and also the use of pesticides which kill off the bats' food. Roads are also dangerous for bats, as they often fly near the ground when hunting, and collide with cars.

A healthy bat population is an indicator of a healthy environment, where plants and insects are flourishing. The world's bats pollinate many plants and disperse seed – some useful plants dependent on bats include dates, vanilla, and bananas.

www.bats.org.uk
www.ptes.org

Water Vole

Water Voles are the largest species of vole in Britain and are sometimes mistaken for brown rats, which can be found in a similar habitat. Water voles have glossy brown or black fur and a blunt muzzle with small, black eyes. Their ears are rounded and almost hidden, and they have a dark, slightly furry tail. Sometimes known as Water Rats, they are not rats at all - they are smaller than rats, and feed off plants.

They are mostly active during the day but if they are disturbed will quickly dive into the water with a plop – they have underwater entrances to their bankside burrows which means they can get home easily if threatened, and also get out fast if there is flooding.

They are now vulnerable to extinction in the UK. This is partly because of the intensification of agriculture, but the release of mink from fur farms in the 1990's was disastrous for water voles – their population crashed by about 90 per cent.

naturalengland.org.uk
rspb.org.uk

Hare

After the Water Vole, the Brown Hare is the species declining most rapidly in the UK.

Hares are much bigger than rabbits, and are thought to have been introduced in Roman times, originating on the grasslands of Central Asia. They have very long black-tipped ears, and can run at up to 50mph. Unlike rabbits, they only live above ground, in shallow scrapes called forms.

Mad March Hares are in fact, females boxing males to stop them pestering them during breeding season – and the females are bigger than the males.

The Brown Hare needs open heathland and lots of choice cereals and wild grasses to survive, and with the intensification of industrial agriculture, and increasing housing development, its habitat is declining rapidly. Humans may still shoot them, and they are often killed on roads.

Hares are generally active at night, foraging at dusk and dawn. They are mostly solitary animals, except during courtship season.

www.hare-preservation-trust.co.uk

Wood Ant

Wood Ants are very important for woodland ecosystems. They are food for animals including badgers, and they feed off pests and so protect trees. They like to 'farm' aphids for the sweet substance known as honeydew that the aphids produce when the ants gently stroke them with their antennae.

The ants also clean parasites off birds. The formic acid that they give off wards off lice and mites – and some birds, such as jays, will make special trips to Wood Ant nests for a spray of formic acid. Abandoned Wood Ant nests provide homes for other animals such as the Shining Guest Ant, and the Leaf and Rose Chafer beetles. Rove beetles will also move into Wood Ant nests, which is not such good news as these beetles eat baby ants.

The largest wood ants can grow up to one centimetre in length. They have a reddish thorax, dark head and abdomen. Similar to bees, the majority of ants in a colony are worker ants, all female and sterile; then there are the males, and also (unlike bees, who only have one) up to a hundred queens who lay eggs. Groups of workers have different jobs: some look after and feed the young grubs, others maintain and repair the nest, others forage for food. The males only exist to mate with the queens – and then they die.

Ants are amazing builders: they live in colonies in mounds, painstakingly built by the ants working together, first heaping up soil, and then topping it with pine needles, leaves, and whatever else is lying around on the forest floor – lichen, moss, dried grass and small pieces of twig. An ant can carry up to 25 times its own body weight – not something a human is capable of!

Ant heaps can grow over the years to enormous heights, housing as many as 250,000 ants. The biggest ant heap in the Midlands is in Bucknell Woods, and may be forty years old.

Although the ants depend on surrounding trees for food and building materials, they also need plenty of gaps where sunshine can come in, to keep the colonies warm. So they are currently at risk as this kind of habitat is decreasing. As people get to know more about Wood Ants and what makes them happy, woodlands can be better managed and protected to suit their needs.

Look out for the distinctive heaps in the woods, and make sure to leave them undisturbed - don't poke or interfere with them in any way - so the colonies can flourish peacefully.

www.woodants.org.uk
woodlands.co.uk
treesforlife.org.uk

Bees

Both honey bees and bumble bees are important pollinators. Without bees, it is far harder to grow successful fruit and flowers. Bees are having problems all over the world; some honey bees are suffering from 'colony collapse' when they die in the hive for reasons that we are not yet quite sure of. And if we lose bees, then we will have problems growing enough food to eat.

Bumble bees are bigger and more furry than honey bees so they can cope with cooler weather, and can survive further north, even as far north as North Canada. But being solitary bees, who do not swarm or live in a hive, they cannot store very much honey, so they need to keep restocking on nectar and pollen. They tend to live in holes in the ground and so are vulnerable to flooding.

Two kinds of bumble bee have become extinct in the UK in recent years. There are plans to re-introduce the short-haired bumble bee here.

The honey bees that most of us see are the female worker bees, who forage for nectar to keep the queen bee fed, and look after the hive and keep it clean. When the workers return to the hive they do a 'waggle dance' which shows the other bees which direction to go in to find pollen and nectar.

Intensive farming kills off wild flowers that are essential for bees. Bees need flowers, and we need bees – if you have a garden, plant lots of bee-friendly flowers in it.

www.bumblebeeconservation.org – the Bumblebee Conservation Trust
www.bbka.org.uk – British Beekeepers Association

Beetles

There are many kinds of beetle eg. Violet Ground Beetle, Oil beetle, Devil's Coach Horse, and many more. See www.uksafari.com.

One of the beetles threatened by loss of food and habitat, is the

Stag Beetle

The Greater Stag Beetle used to be common in Britain. Now however these beetles, the largest ground dwelling beetles in the UK, are on the edge of extinction, mainly because we have become too tidy - the beetle larvae need to feed off rotting wood for about three years, after which they pupate. They can take up to three weeks to build an egg-shaped cocoon about 20cm below ground. They emerge from their cocoon in the autumn and spend the winter and spring in the soil. The males are a bit bigger than the females.

While it can take up to six years for an egg to finally turn into a beetle, the adult beetle's life is short – about six weeks. They come out of the ground around May, when they mate and the female lay their eggs in rotting wood. Adult beetles do not seem to eat, and by the end of the summer most of them have died.

They are called stag beetles because of the antlers on the male, that look like miniature stag's antlers. These 'antlers' are in fact mandibles or mouth parts, and are used to lock together in fights – over a female, or ownership of a log, but they rarely fight to the death.

www.ptes.org
stagbeetles.co.uk
www.stagbeetlehelpline.co.uk

Dragonflies

In Britain we have Dragonflies and Damselflies, which are all part of the same family. Although we still have many that are flourishing, about a third of UK species are in decline.

Dragonflies have unequal sized wings – the back wings are slightly shorter and broader than the front ones, whereas Damselflies' wings are roughly all the same size. Damselflies are also smaller, and tend to fly close to the water.

The first of their kind lived over 300m years ago – 100m years before the dinosaurs. The largest known insect to have lived was a dragonfly with a wingspan of 28inches.

They see well – they have large compound eyes with up to 30,000 lenses.

The larvae are wingless and live in the water, feeding off small animals including tadpoles. They do not pupate, but keep moulting – up to 17 times in some cases. The larvae live underwater for one or two years, but the adult dragonflies usually only live for one or two weeks, during which time they mate and the females lay eggs.

www.british-dragonflies.org.uk
pondconservation.org.uk

Butterflies and moths

Butterflies and moths have been compared to canaries in coal mines as they give very early warning signs of environmental threats. They are extremely sensitive to their surroundings because their life cycle means they require very specific habitats: the caterpillars must feed off the right plants, and then find somewhere safe to be pupae. Adult butterflies feed off nectar so they need lots of wild flowers. In the past when farming was not mechanised, there were many more hay meadows full of wild flowers in the UK. However, now farmers often prefer to plant fast growing grass to be used for silage – and unfortunately this grass does not support wild flowers.

Pesticides and fertiliser are poisonous to butterflies and moths, and if our climate changes and we continue to have very wet summers it will be hard for the insects to survive as they need warm sunny summer days to stock up on nectar and lay their eggs. Mechanical hedge cutting also destroys some butterflies' habitat, such as the Brown Hairstreak, which likes to lay her eggs in blackthorn hedges. However, some butterflies that were in decline, such as the Silver-washed Fritillary, have increased again because more care is being taken to make sure they have suitable habitat.

The difference between butterflies and moths is somewhat artificial. In general, moths are nocturnal (active by night) and butterflies diurnal (active by day) but that is not always the case.

Declining butterfly and moth populations are not good news for the many animals that feed off them and caterpillars – for example, some small birds depend on caterpillars to feed their young, and bats on the wing like to munch on moths. As the climate gets warmer, some caterpillars are hatching earlier, and this can be a problem for migrating birds if they arrive too late and the caterpillars start to pupate before they can feed them to their young.

Some butterflies migrate long distances – the familiar Red Admiral, for example, flies to Britain and Ireland all the way from N. Africa or S.Europe. The famous Monarch butterfly flies 3,000 miles from the U.S to Mexico for the winter, and sometimes Monarchs will make their way across the Atlantic to us.

If you have a garden, find out which flowers are good to plant for butterflies and moths in your area.

www.butterfly-conservation.org

Www.britishbutterflies.co.uk

Spiders

Spiders are arthropods, like insects, but they are not classified as insects because they have four pairs of legs, no antennae, and only two main body parts. Insects have three pairs of legs, antennae, and three main body parts (head, thorax, abdomen). Like insects, spiders have a tough outer covering called the exoskeleton. Despite scary stories, only a few spiders are poisonous enough to hurt humans, such as the Black Widow, or the Tarantula. All spiders are carnivorous – they eat other insects – and female spiders often eat the males after mating.

Not all spiders make webs, but they nearly all produce silk, used for lines to haul themselves up like mountain climbers, wrapping up prey or protecting eggs. Water spiders make their own diving bell out of silk, which they fill with air and then stay in under water while they are hunting prey.

Baby spiders do something called 'ballooning' – they spin a thread and then use that to launch themselves into the air. Sometimes they find a jet stream which will carry them up for miles, as high as an aeroplane or higher. And yes, there's a jumping spider that lives on Mt Everest!

www.buglife.org.uk

www.arkive.org

Crickets and grasshoppers

Crickets and grasshoppers have long back legs that enable them to jump. Crickets have very long antennae, while those of grasshoppers are short. Grasshoppers are strictly vegetarian, whereas older crickets will eat other insects.

Their characteristic song is made by rubbing a forewing against a hind leg (grasshoppers) or rubbing two forewings together (crickets), and they 'hear' by feeling vibrations.

They will only sing once the air temperature is high enough, and as it gets hotter, they chirp faster. Some of the sounds they produce are too high for us humans to hear, but on a warm sunny day, listen for them in long grass – and if you are quiet, you may see one jumping.

Unlike other species, crickets are on the rise in the UK, though they do not do well in wet summers.

www.buglife.org.uk

Adders and Grass Snakes

The Adder is the only poisonous snake in Britain, but it is unlikely to bite anyone unless trodden on or held. Their bites are painful, but not usually fatal - no-one has died from an adder bite here in the UK in the last 20 years.

They are quiet, secretive creatures who like to live at the edges of woodlands or on heaths. They feed mainly off small rodents and lizards.

Female adders do not lay eggs, but give birth to tiny, perfectly formed baby adders.

Their numbers are declining, which is bad news for buzzards, who like to snack on a snake.

If you are out walking and encounter an adder, treat it with respect and leave it in peace.

Grass snakes are found throughout England and Wales. They are much bigger than adders – they can grow to over a metre in length. They are not poisonous, and they are very shy – they don't like to be disturbed. They feed mainly off fish and amphibians, and stray grass snakes may turn up in garden ponds in the summer. They have a distinctive 'collar' of green and black.

Female grass snakes lay eggs from which the baby snakes emerge in late summer. The eggs are laid in warm rotting vegetation – which could be a compost heap.

Both adders and grass snakes are protected by the law.

www.arc-trust.org

Slow Worm

Slow worms are lizards, but are often confused with snakes. Unlike snakes, they don't have eyelids and if they're trying to get away from a predator they can shed their tails.

They like to hide under logs, or in warm compost heaps, and unlike snakes, do not bask in the open. You can find them in gardens. They feed mainly off insects, especially small slugs, so very useful to have around in the garden! They are protected by law, like adders and grass snakes.

www.arc-trust.org

Birds

Owl

The Owl in Bugs Came First is probably a **Barn Owl**, so called because they like to nest in old barn rooves or abandoned buildings. Old barns are getting harder to find now, as many are converted into houses, but Barn Owls will use strategically placed nesting boxes.

They are sometimes called screech owls because of their screeching loud call.

They are snowy white underneath, and have such good hearing they can hear mice or voles (their preferred food) making tiny movements down on the ground. One ear is placed slightly higher than the other, and their big faces covered with feathers are able to detect and amplify the slightest sound. Underneath all its feathers an owl is quite small.

They are found in places where there is plenty of open ground with rough grass where they can hunt mice, voles, the occasional frog, and insects. (This is why the Frogs keep their distance when visiting Owl.)

www.barnowltrust.org.uk

rspb.org.uk

Other UK owls include the Tawny Owl (that's the owl that goes 'too whit, too whoo'), the Little Owl (introduced into Britain in the 19th century) and the Long and Short-eared owls.

Swallows

Swallows migrate to the UK from S. Africa, where they spend the winter. For such tiny birds, the distance they fly, and the perils they endure during migration, are extraordinary.

They are recognisable by their long forked tails and blue heads.

They like to nest in eaves, and their swooping flight, as they catch insects on the wing for food, is unmistakable. They will often sit together in roosts chattering, and in the Autumn you can see them gathering before the long migration back to Africa.

They are declining across Europe, and scientists are not sure why, although different farming methods in Europe and Africa probably have something to do with it, as well as climate change, and the fact that the Sahara desert, which they have to cross on their migration, is expanding. Since they cannot touch down in the desert, this part of their journey is especially gruelling.

Swifts

Swifts are bigger and faster birds than swallows. They are highly sociable, and love to indulge in high-speed swooping and shrieking in flocks, often around houses at dusk in the summer. They can stay in the air for days and sleep on the wing. They don't hang out together on telegraph wires like the swallows, but like to stay on the move – they also migrate.

Their forked tails are shorter than the swallows', and they are dark-brown/black and white, with curved wings.

They too are suffering from loss of nesting places and habitat.

Bar-tailed Godwit

This is a wading bird with a long narrow beak that comes to the UK in the winter from the Arctic. They can fly thousands of miles without stopping for food or drink. Recently a Bar-tailed Godwit was tagged that flew from New Zealand all the way to Alaska, its breeding ground, in eight days. Young godwits of two months old can make this journey on their own without the adults to guide them.

Buzzard

Buzzards are the largest of the UK birds of prey. They look very relaxed flying over open ground as they search for prey.

This lovely bird suffered a sharp decline when the disease myxomatosis killed off large numbers of rabbits, its favourite food. Now however, the rabbit population has bounced back and so have the buzzards. In addition, gamekeepers used to kill buzzards in the belief that they hunted pheasants, but fortunately the buzzard is now legally protected.

Despite being a predator, buzzards are often mobbed by members of the crow family – and are usually the losers!

Woodpecker

There are three kinds of woodpecker in the UK– the Green, the Great Spotted, and the Lesser Spotted.

The most common is the Great Spotted – listen out for its 'drumming' on old wood. The smallest woodpecker, the Lesser Spotted, is also the rarest. These woodpeckers feed off insects, seeds and nuts.

The Green is the largest, and feeds exclusively off ants. Its call sounds like a raucous laugh.

Peregrine Falcon

These birds are now legally protected in the UK. They suffered badly from human persecution, and the introduction of pesticides, which indirectly poisoned them via the prey they eat. They are large and powerful birds, and one of the fastest in the world – a peregrine can reach over 100mph when dropping from the sky after prey.

They used to be found mainly on coasts and in the uplands, but now they are increasingly moving into large cities where they can nest in tall buildings and prey on unsuspecting pigeons. They are found on every continent except Antarctica.

www.london-peregrine-partnership.org.uk – helps to protect the birds that are living in the London area.

Cormorant

Just 35,000 cormorants are now resident in Britain. They are found along rocky coasts and estuaries, and inland at lakes and reservoirs, and have an old, and completely undeserved, reputation for being sinister.

The cormorant has a long neck and forms a distinctive dark silhouette when perched with its wings hanging out to dry. They are excellent fishers and have encountered prejudice from amateur anglers who compete with them for fish.

Animals from other parts of the world

Grey Wolf

The wolf is gradually making a come back in Europe and N.America, but is vulnerable to persecution by humans who perceive them as dangerous and a threat to livestock. Wolves prefer to stay away from humans, but if they lose their habitat because of human development, then they are forced to look for other sources of food, which may be farm animals, and of course this gets them into trouble with humans.

See www.transylvanianwildlifeproject.com, about wolves in Romania

Brown Bear

This bear is still living in forests in Romania. Bears feed off fish, small mammals, and also fruit and vegetation.

They spend half the year hibernating in their dens underground, where the mothers give birth. During this time the mother will not eat, but will be feeding her cubs on milk, so when they emerge in the Spring they have to find food as quickly as possible. But they have to watch out – hungry male bears will eat bear cubs if there is nothing else around.

North American brown bears are called grizzlies.

Asian Vultures

Until the twentieth century, vultures were very numerous in India and Pakistan.

They play an important role – they scavenge meat from dead carcasses, often cattle, which prevents disease spreading in the hot climate. Vultures are resistant to infection from these carcasses. As the vultures decline, rats and wild dogs take over the scavenging, who, unlike the vultures, are susceptible to bacteria, and can spread diseases such as rabies that affect humans as well as other animals.

Because of prejudice and some superstition, it has taken a while for people to get educated and understand the importance of these birds, both in the ecosystem, and in regard to human health.

Since the 1990's, the three main species of vulture in India have declined by about 97%, because of a drug used by vets, called Diclofenac, and another, more recent drug which is also fatal to vultures. Many, many vultures had died before scientists realised that Diclofenac is deadly poisonous to them.

SAVE – Saving Asia's Vultures from Extinction – is working to save the vultures, by getting the drug Diclofenac totally banned (there is an alternative drug, which does not harm vultures), creating vulture safe havens and 'vulture restaurants' with poison-free meat for the birds to eat, and breeding birds in captivity to be released back in the wild when there is no risk of consuming the drug.

www.rspb.org
vulturerescue.org

Asian Tiger

Once common all over Asia, there are now only just over three thousand tigers living in the wild, mainly in India, Nepal, Bhutan and Bangladesh.

The South China tiger is one of the ten most endangered species on the earth.

Tigers need to live and hunt over an enormous range, and as their forest habitat is destroyed their population is becoming increasingly fragmented. The area they occupy has dwindled massively since the 1990's due to illegal logging.

Despite having protected status, and heroic work done by conservationists, tigers are still illegally hunted and killed, mainly because their body parts have been used in medicines for centuries and people are reluctant to accept the extent of the crisis.

The existence of these magnificent creatures remains in the balance.

www.bornfree.org.uk works to help conserve the Bengal Tiger in India
www.tigersin crisis.com has information about Siberian and other tigers.

African elephants are the largest land animals on Earth. They are slightly larger than their Asian cousins and can be identified by their larger ears that look somewhat like the continent of Africa. (Asian elephants have smaller, rounded ears.) Elephant ears radiate heat to help keep these large animals cool, but sometimes the African heat is too much. Elephants are fond of water and enjoy showering by sucking water into their trunks and spraying it all over themselves. Afterwards, they often spray their skin with a protective coating of dust.

They have a range of sounds for communication, including hums, whistles, roaring and trumpeting. To communicate over long distances – up to about twelve miles - they use infrasonic frequencies that humans cannot hear, but can be aware of as a vibration. They can send messages hundreds of miles by relaying these low sounds from one group to another.

An elephant's trunk is actually a long nose used for smelling, breathing, trumpeting, drinking, and also for grabbing things—especially a potential meal. The trunk alone contains about 100,000 different muscles. African elephants have two fingerlike features on the end of their trunk that they can use to grab small items. (Asian elephants have one.)

Both male and female African elephants have tusks they use to dig for food and water and strip bark from trees. Males use the tusks to battle one another, but unfortunately it makes them vulnerable to a worse kind of attack. Because ivory is still so valuable to some humans, many elephants have been killed for their tusks. This trade is illegal today, but it has not been completely eliminated, and some African elephant populations remain endangered. Now male elephants are growing shorter tusks, which seems to be an evolutionary response to the threat.

Elephants eat roots, grasses, fruit, and bark, in vast quantities. An adult elephant can consume up to 300 pounds (136 kilograms) of food in a single day.

Despite their weight elephants can be extremely graceful and are able to walk on tiptoe, soundlessly.

Asian elephants are at greater risk of extinction than African

www.earthorganization.org – has come out of the pioneering work of Lawrence Anthony to help elephants in Africa

Sloth

Two and Three toed Sloths live in the tree canopy of rainforest of Central and S.America. The sloth is the slowest moving mammal on earth. Males are solitary and shy, females sometimes live in groups. It is sometimes known as 'ais' (pronounced 'eyes') because of its high-pitched call.

The three-toed sloth only eats leaves; the two-toed also eats some fruits. Since leaves take a long time to digest, the sloth has an extra large stomach, and a very slow metabolism. It sleeps for 15- 20 hours a day, and its few waking hours are usually at night. When it is digesting food, its temperature drops, so it likes to bask in the sun.

It clings on to trees with its very long claws, but has little muscle in its back legs. Algae grows on its back, and many kinds of insects live in its fur, including a particular moth. The sloth comes down from its tree only about once a week to defecate – at which point the moth flies out and lays its egg in the droppings.

Slime Moulds

Slime moulds are not fungi, though they may resemble them. Nor are they animals. They spend most of their life as single-celled amoebae, living in dark damp places on the ground, such as leaf litter. Then, when they are starving, they clump together and move as a single organism that can detect food sources, and is attracted by certain chemicals.

Some of the spores become a stalk, which eventually dies, and some become a fruiting body, that releases spores to create more slime moulds.

John Bonner is an American scientist who has spent his life researching slime moulds. See <http://www.youtube.com/watch?v=bkVhLJLG7ug> for a fascinating short film about Bonner and his slime moulds.

Primates (yes, that's you and me too)

Monkeys

Old World monkeys: baboons, macaques, and colobus monkeys live in Africa and Asia;

New World monkeys: marmosets, tamarins, and capuchins live in South and Central America

Prosimians: lemurs, lorises, and tarsiers live in Africa and Asia

Apes are a branch of Old World Monkeys who lost their tails and doubled their brain size. They are 'super monkeys', and we are the seventh Ape. The biggest ape is the gorilla, the smallest the pygmy

mouse lemur.

Great apes: gorillas, chimpanzees, orangutans, and bonobos live in Africa and Asia

Lesser apes: gibbons and siamangs live in Asia

Apes are omnivorous. They make and use tools. They have lifelong family bonds, and communicate using calls, touch, visual cues and body language..

They make comfy nests to sleep in, with softer leaves as pillows, a new one each night. Only mothers and babies/children share nests. Young chimps stay close to their mothers till they are about seven years old and their mothers carry them on their backs everywhere.

Apes have suffered extreme habitat loss – their population in Central Africa has dropped from 1-2 m at the beginning of the 20th century, to about 3,000 in the wild today.

We humans share 95- 98 % DNA with apes.

Jane Goodall and the Gombe Chimpanzees are famous. The Jane Goodall Institute continues to do groundbreaking conservation work in Africa and all over the world.

www.janegoodall.org

Sumatran Rhino

The smallest rhino, native to mountain forests in Malasia and Indonesia, this is one of the most threatened large mammals on the earth – there are thought to be only about 400 surviving in the wild, and they do not breed well in captivity. They are largely solitary animals, who feed off leaves, grass, shrubs and twigs. They have hairy hides which get coated with mud and keep them cool.

The Sumatran rhino has two horns which are smaller than those of other rhinos. But this has not saved it from being poached. The horns are used for medicines in some countries.

The rhino's habitat is declining as its native forest dwindles, so the outlook is bleak for these wonderful animals.

savingrhinos.org
[nationalgeographic .co.uk](http://nationalgeographic.co.uk)

Hippo

There are two kinds of hippo, common and pygmy. They live only in Africa, and their populations are in decline. The Greeks named them the "river horse" because they spend so much time in water keeping cool. They are good swimmers, and can hold their breath underwater for up to five minutes. However, they are often large enough to simply walk or stand on the lake floor, or lie in the shallows. Because their eyes and nostrils are high up on their heads, they can see and breathe when the rest of their body is underwater.

They also like to bask in the sun and produce a red substance from their skin that works as a skin moistener and sunblock.

They are herbivores – they eat grass. They can travel up to 6 miles on land at night, eating about 80

pounds of grass.

A new-born hippo usually weighs about 100 pounds (45 kilograms) at birth. Each female has only one calf every two years. Soon after birth, mother and young join schools that provide some protection against crocodiles, lions, and hyenas.

www.moray.ml.duke.edu - has information about the work of the International Hippo Foundation

Marine animals and the state of the world's oceans

The Oceans

The oceans cover about 70% of the earth's surface, and are home to a stunning array of biodiversity. There are more animals living in the sea than on land.

Until quite recently, people thought that, unlike land, the oceans could never change, and that there would always be as many fish to eat as we wanted. However in the past thirty years there have been alarming changes. Human activity is destroying the life in the ocean on which we depend, and we need to act fast to change course.

Stocks of fish near populated coastlines have been severely reduced and in some cases wiped out, and deep sea fishing is turning seabeds, previously rich with life, into deserts.

Pollution from agricultural and other chemicals, sewage and plastic rubbish is poisoning the sea, destroying complex habitats and killing animals and plants. There are now 'dead zones' where nothing can grow because there is no oxygen left in the water.

As the world gets hotter, sea levels are rising and increased CO₂ in the water makes it more acidic.

The whales in *Bugs Came First* call to the children for help, and there are things we can do. One is to support the initiative for more Marine Conservation Areas, (like Nature Reserves on land). Currently only 2% of the world's oceans are protected, and the UN Convention for Biological Diversity has called for that to increase to 10% by 2020.

The Marine Conservation Society wants 127 protected areas around the coasts of Britain.

www.mcsuk.org

www.sylviaearlealliance.org

www.globalpartnershipforoceans.org

The Great Pacific Garbage Patch

'To save the ocean, you must go back to the land'

Unfortunately there is more than one great marine garbage patch, but that in the Pacific is one of the largest. Initially discovered by lone sailor Charles Moore, it is about the size of Texas. It consists of rubbish thrown out of boats, contents of capsized container ships, and rubbish that has drifted into the sea from the land.

The patch is not just solid plastic, but includes tiny pieces of plastic that photo-degrade in sunlight and are then passed into the food chain. It is disastrous for marine animals and birds who cannot digest plastic, but often mistake brightly coloured fragments and plastic bags for food.

Plastic rubbish in the world's oceans increased by 5,000% between 1984 and 2005.

Don't drop plastic! Anywhere! Ever!

Seals

There are many varieties of seal; in the UK we have Grey and Common Seals, Grey Seals are larger and heavier than Common Seals.

Just under half of the world's population of Grey Seals live off the coast of Britain, and their numbers have remained stable for several decades. In other parts of the world though, seals have been hunted nearly to extinction.

Though clumsy on land, seals are superb swimmers once in the water where they hunt for fish. Even when there is no visibility underwater, they can detect fish with their super-sensitive whiskers.

They give birth in the autumn in their colonies; mothers bond immediately with their pups by calling to them and smelling them.

In the wild, male Grey Seals live for about 25 years, and females 35.

A seal stretching its flippers is a wonderful sight.

www.sealsanctuary.co.uk
www.visitsealife.com – Gweek Seal Sanctuary, Cornwall
www.snh.org.uk

Galapagos Tortoise

Today the 3,000 to 5,000 tortoises that live on Volcano Alcedo on Isabela Island are the largest group of giant tortoises in the Galápagos. They can live to a very great age – the oldest tortoise recorded lived to 152. Just possibly one of the current Galapagos tortoises would have been a hatchling when Charles Darwin visited in 1835. They are also the biggest tortoises in the world, weighing up to 250 kilograms and reaching over 5 feet in length.

Unfortunately they were mercilessly hunted for food by sailors and pirates and died in their thousands during C17 – 19. Now hunting has stopped, but rats and dogs steal their eggs, so they are still at risk. The tortoises are listed as endangered and have been strictly protected by the Ecuadorian government since 1970. Captive breeding efforts by the Charles Darwin Research Station are also having positive effects.

If left in peace, Galápagos tortoises lead a simple life, grazing on grass, leaves, and cactus, basking

in the sun, and sleeping for nearly 16 hours per day. A slow metabolism and large internal stores of water mean they can survive up to a year without eating or drinking.

Spanish sailors who discovered the archipelago in 1535 actually named it after the abundant tortoises; the Spanish word for tortoise is galápagos.

Coral

Coral is made up of many tiny animals called polyps, which are cylindrical in form with an open top surrounded by tentacles. These individuals are connected by tissue, food ingested by one is food for all, and they can communicate with each other - if a polyp is attacked it will retract into its cup and as the message is passed along, all the other polyps will gradually retract too.

Corals get their colour mainly from millions of tiny single-celled algae that live in the polyps and photosynthesise, providing food and oxygen for the coral. Reef-building corals grow in shallow sunlit waters where it is easy for the algae to photosynthesise. New living coral grows on older dead coral and so the reef slowly builds up. Many other animals live, feed or rest on coral reefs.

Corals in deeper water feed off passing small animals that they trap with their tentacles using poisonous 'harpoons' on each tentacle.

Corals spread by cloning, accidental damage (a piece breaks off and forms another colony) and synchronised spawning.

Recently, coral reefs have started to bleach and die. One reason for this is rising water temperatures, which kills off the algae. Pollution also damages corals, as it causes an overgrowth of seaweed that blocks out the sunlight and prevents photosynthesis.

Giant Clam

These clams are the largest molluscs on Earth, capable of reaching 4 feet (1.2 meters) in length and weighing more than 500 pounds (227 kg). They live in the warm waters of the South Pacific and Indian Oceans.

The young clam larva swims around freely, and then attaches itself to one spot on a reef for the rest of its life.

Clams cultivate algae in their mantle, which acts like a greenhouse. The algae photosynthesise and produce sugars and proteins which the clam eats. In return, the clam provides the algae with a safe home, access to sunlight as it basks below the water's surface, and waste products that the algae convert into food. The algae also help to build the clam's huge shell.

Contrary to popular belief, giant clams do not attack humans. They are peaceful creatures who avoid conflict. They are hermaphrodite.

Sharks

Sharks have a bad reputation, possibly worse because of the film *Jaws*. In fact about 750,000 sharks are killed by humans in a year, and about four humans a year killed by sharks. They are at risk partly because their fins are considered a delicacy so they are hunted for food.

They are top predators, and can live to a great age – Whale Sharks take thirty years to mature, ie. until they are ready to reproduce, and it is thought they can live up to 100 years. They have no bones: their skeletons are made from cartilage, which makes them very fast and agile, and means they can open their mouths extremely wide!

Modern sharks have been around for the last 34,000,000 years – whereas we humans have only been on earth for the past 200,000 years.

Recently, the island of Palau banned all commercial shark fishing, thereby creating a shark sanctuary of c.230,000 square miles.

There are many different kinds of shark including catsharks, swellsharks, shysharks, houndsharks, weasel sharks, requiem and hammerhead sharks.

Sponges

Sponges come in many different shapes and sizes – from half an inch to over six feet . They have no nervous system, muscles, or stomach. Their cells are specialised, and each cell can transform from one type to another. This means a sponge can completely regenerate from a fragment or even individual cells.

Most adult sponges spend their lives attached to a reef, though the larvae are free swimming.

Sponges have skeletons completely unlike ours, made from spikey 'spicules' scattered through the sponge's body, which may be made of calcium (like ours) or silica. Over 90 % are made from silica.

Most sponges are hermaphrodite, and reproduce sexually, freely exchanging sperm and eggs. They can also reproduce asexually, by fragmenting, growing buds that eventually break away, or by sending out 'gemmules', collections of cells and tiny food particles that can stay dormant until conditions are favourable for growing into a proper sponge.

They feed off microorganisms in the water, absorbed through tiny pores called ostia, that travel through a system of canals inside the sponge until being expelled through the osculum. A few more vicious sponges send out hooks and capture crustaceans to eat.

They are found in shallow and deep seas, and a few in freshwater lakes and rivers.

Leatherback Turtle

Leatherbacks are a very ancient species, whose lineage goes back more than 100 million years. They are the largest turtles on Earth, growing up to seven feet (two metres) long and exceeding 2,000 pounds (900 kilograms).

They migrate the furthest of all turtles, averaging 3,700 miles (6,000 kilometers) each way. They can dive down to 4,200 feet (1,280 metres) – and stay down for as long as 85 minutes.

Unlike other sea turtles, their shells are smooth and almost flexible, and a thick layer of fat helps them to keep warm in cold water.

Leatherbacks' favourite food is jellyfish. Unfortunately because they do not see very well, they can mistake plastic bags for jelly fish and die after eating them.

Leatherbacks are currently designated as endangered under the U.S. Endangered Species Act.

www.turtles.org

Whales and dolphins

Whales are the largest mammals known on earth today, far bigger than elephants. Whales and dolphins are known as Cetaceans.

The Blue whale is nearly 100 feet long, and eats a million calories a day. Its tongue is heavier than an elephant, and its heart weighs half a ton.

Whales can navigate in total darkness, using sound, magnetism, and their internal map of the sea's geography.

Dolphins and whales 'hear' in a way equivalent to 'seeing' with an x-ray. They hear sound reflected from any part of the body that holds air. In this way they can communicate and read each other's emotional states.

Like elephants, whales can communicate over great distances, though this is badly affected by human-caused noise from shipping and submarines etc (see below). Different whales have different characteristic sounds, including clicks, whistles, sqwawks and grunts. Some of these sounds are obviously used for orientation, by means of echo-location. Some dolphins know each other by name – each one has its own unique 'signature' whistle – this is especially important for the dolphins when they return from an excursion and need to find their young.

Humpback whales sing for hours on end, and change and adapt their songs continuously. They do not have individual 'signature' sounds, instead a whole group shares its own song, which may last up to thirty minutes before being repeated.

Some whales songs when speeded up sound just like birdsong.

Humpbacks feed in cooler waters and migrate to warmer waters to breed – a journey of up to 6,000 miles. They have three main migration routes: from the North Pacific to Hawaii, from the NW Atlantic to the Caribbean, and from Antarctica to the Great Barrier Reef, off Australia. In the winter they stock up on food in the colder waters, and go to the warmer waters to breed. While suckling her young, the mother may not feed – imagine going for months without food and then having to swim six thousand miles before you had your next meal! The baby whales do the first migration with their mother, but after that they must find their way alone.

Whales feed off plankton, tiny animals and plants in the sea that contain oxygen. The whales

recycle this oxygen into the earth's atmosphere, thus helping us humans to survive.

Whales love playing – when a whale 'breaches' it jumps with the whole of its body right out of the water.

Until the 1960's whales were hunted ruthlessly until finally hunting was banned for all except a few indigenous tribespeople who hunt by hand. But like all marine life, whales are threatened by human pollution and waste that runs off the land into the seas, loss of habitat, fishing, if they get caught in nets by mistake, and tourist pursuits such as jet-skiing and para-sailing. Noise pollution is a huge problem – see below.

www.wdcs.org – whale and dolphin conservation society

Underwater sounds

Under the surface of the sea is a world of sound – that has been called 'acoustic daylight'. When visibility is poor – and it can be murky deep in the ocean - an animal can find things out about its environment by listening. Free-ranging larvae from coral reef fish, for example, have to find their way back to the reef when they grow up, otherwise they will die – they know how to recognise the sounds of waves breaking on rocks, shrimps snapping and crabs crackling. Careful listening is important to avoid predators, or to find prey.

Fishes hold countless conversations underwater: triggerfish grind their front teeth together and drum with their fins – and if they get quarrelsome, they will become more brightly coloured as they drum. Damselfish chirp, grunt and pop, to defend their territory, and each species makes a slightly different sound. Pilot whales (actually dolphins) produce twitters, clicks and popping. They are very social animals and chat in a group.

Animals also use sound as signals, to attract mates or deter predators – male toadfish hoot and grunt, using their swim bladders to attract females and warn off other males.

Sound travels further through water than it does through air. Additionally, in the sea there is a narrow piece of water between the warm upper layer and the cold deep layer (the thermocline boundary) and sound trapped in this layer travels particularly far. Scientists think that whales may use this layer of water as a kind of telephone to talk over very long distances – thousands of miles!

Unfortunately the sea is now full of noises, caused by humans and human inventions, that are making it difficult for other animals to hear their own sounds. Whales literally have to shout now to hear each other over the sound of ships' engines, underwater sonar equipment, and the noise of explosives used in oil and gas exploration. They are also singing at a higher frequency. Some whales have been seriously injured or killed by naval sonar systems, and the increasing hubbub of human activity is causing other animals and fish in the sea to be stressed. It is known that fishes' hearts beat faster when they hear the sound of boat engines.

One way to decrease the stress for fish and marine animals is for boats to go more slowly, so that the engines make less noise, and this is starting to happen. Some coastal resorts now ban tourists from using motorboats, especially when animals are breeding.

Some other amazing marine life forms:

Sea Lily

The Great West Indian Sea Lily has been around for about 230 million years, as proved by fossil remains that are virtually identical to modern Sea Lilies. They are animals, not plants, that grow up to 2 feet tall, hanging on to rocks with claw-like hooks. They can move very slowly, imperceptibly to us, by detaching their arms from the rocks and crawling along the sea bottom.

Christmas Tree Worm

These lovely animals live in or around the coral head and help to deter predators.

Sea Fan

A form of fragile soft coral that feeds at night.

Moray Eel

Though they have a reputation for being aggressive, they are timid and hide in holes in rocks during the day, coming out to feed at night. They open and close their mouths continuously, as they need the flow of water to breathe.

Squid

Squid can be enormous, up to 150 feet long. They survive on very little oxygen and so are able to cope with rising sea temperatures. They are highly intelligent, playful, and change colour according to their emotional state. They have hooks and suckers to grab their prey, and have a stiff structure that serve as a backbone. **Octopus** are related to squid, but are completely soft-bodied which makes them able to squeeze through very narrow places. They paralyse their prey with venom.

Starfish

These are not fish, but belong to the same family as sea urchins (echinoderm). There are about 2,000 different kinds of starfish in the earth's oceans. One of the largest, the Crown of Thorns starfish feeds off coral, and is capable of destroying an entire reef.

Starfish can regenerate limbs and even whole bodies.

Coelocanth

First living specimen found in 1938, previously only known from fossils – the most recent being from 65 million years ago, during the Cretaceous.

Known also as Old Four legs, and The Living Fossil.

See www.dinofish.com, the coelocanth rescue mission

Kelp Forests

Kelp grows anchored to rock, in nutrient - rich cold water. The plants can spread for thousands of metres. They have huge blades with small bladders on the top to keep them floating in the sunlight for photosynthesis.

Lots of small animals such as sea snails live in kelp forests.

Sea otters sleep at night wrapped in kelp fronds, and Grey Whales go to the Californian coast in winter to graze off tiny animals in the kelp.

Kelp forests provide a safe home for young fish such as Wrasse and Garibaldi. They also absorb CO₂, so are incredibly important as plentiful kelp forests will slow the warming of the oceans caused by climate change.

Sea Birds

Albatross

Albatross fly for thousands of miles over the world's oceans, foraging for fish and other creatures on the surface of the sea. They have a massive wing span: up to 11 ft! (3.4 m).

They are encountering problems now, as sometimes they mistake scraps of plastic for food, which they feed to their chicks who end up dying of starvation. They have also suffered notoriously from oil spills which clog up their wings making it impossible for them to fly.

They can fly for days on the right sea winds, and once a young albatross leaves its nest, it may not touch land again for 5 -10 years.

Birdlife International has linked with the RSPB in a campaign to protect albatrosses.

www.rspb.org.uk

Arctic Tern

Also known as the Sea Swallow, the Arctic Tern does the longest of all migrations, from the Arctic to the Antarctic and back, about 43,000 miles. Yet they are small birds, weighing little more than 100 grams.

They come to N.Europe and the Arctic Circle in our summer, returning to Antarctica for our winter, which is the Antarctic summer.

They can be seen in N.England and Scotland during the breeding season.

www.rspb.org.uk

The Great Pacific Garbage Patch

This was initially discovered by lone sailor Charles Moore. It is one of the largest marine garbage patches, about the size of Texas. It consists of rubbish thrown out of boats, contents of capsized container ships, and rubbish that has drifted into the sea from the land. The patch is not just solid plastic, but includes tiny pieces of plastic that photo-degrade in sunlight and are then passed into the food chain.

It is disastrous for marine animals and birds who cannot digest plastic, but often mistake brightly coloured fragments and plastic bags for food.

Plastic rubbish in the world's oceans increased by 5,000% between 1984 and 2005.

www.sylviaearlealliance.org - the Alliance works to create protected marine habitats around the world.

mcsuk.org is a UK organisation campaigning for sustainable fishing, clean seas and beaches, and protected marine areas around the UK.