Curriculum Visions

# The Coast Book

## SECOND EDITION

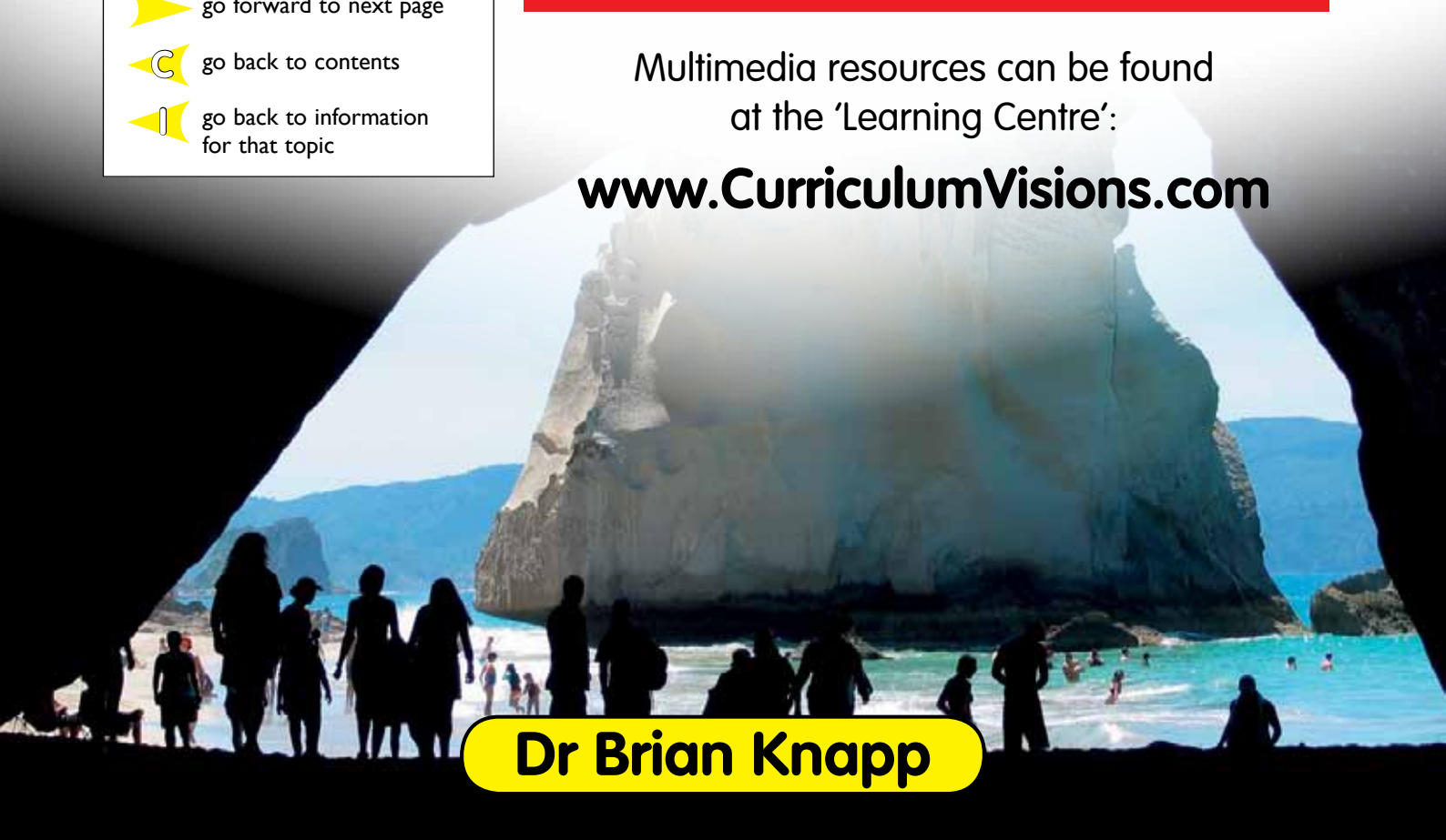
**Key to interactive features**
Press Teacher's Resources box right to go straight to Contents page.
Click on any item in the Contents to go to that page.
You will also find yellow arrows throughout that allow you to:

- go to worksheet
- go back to previous page
- go forward to next page
- go back to contents
- go back to information for that topic

## Teacher's Resources Interactive PDF

Multimedia resources can be found at the 'Learning Centre':

**www.CurriculumVisions.com**



Dr Brian Knapp

Curriculum Visions

**A CVP Teacher's Resources**
**Interactive PDF**



**ISBN 978 1 86214 610 5**

**Author**
*Brian Knapp, BSc, PhD*

**Senior Designer**
*Adele Humphries, BA, PGCE*

**Editors**
*Lisa Magloff, MA, and Gillian Gatehouse*

**Illustrations**
*David Woodroffe and Nicolas Debon*

**Designed and produced by**
*Atlantic Europe Publishing*

**Acknowledgements**
We are grateful to the following for permission to reproduce their copyright material:

*National Hazards Observer* for the illustration on page 82.

# Contents

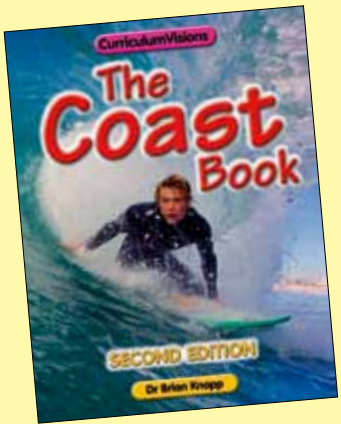
# Section 1: Resources

Welcome to the Teacher's Resources for 'The Coast Book' Second Edition.

The Coast resources we provide are in a number of media:

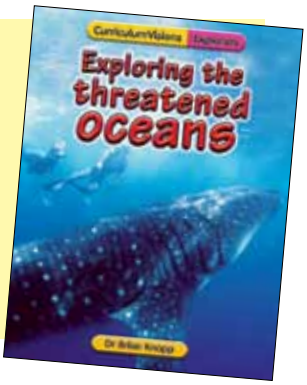
1

You can buy 'The Coast Book' Second Edition. This is 48 pages long and covers the geographical principles of coastal environments.




2

You can buy the 'Exploring the threatened oceans' book which is 32 pages long.




3

You can buy the Coast PosterCard Portfolio – four posters and a total of 28 A4-sized key diagrams/photographs on two folded, double-sided and laminated sheets.

In addition you can buy the 'How Coasts Work Poster' and the 'Coastal Environments Poster'.



4

You can buy the supersaver pack that contains 1 copy of each book and poster, and the Teacher's resources (what you are reading).

5

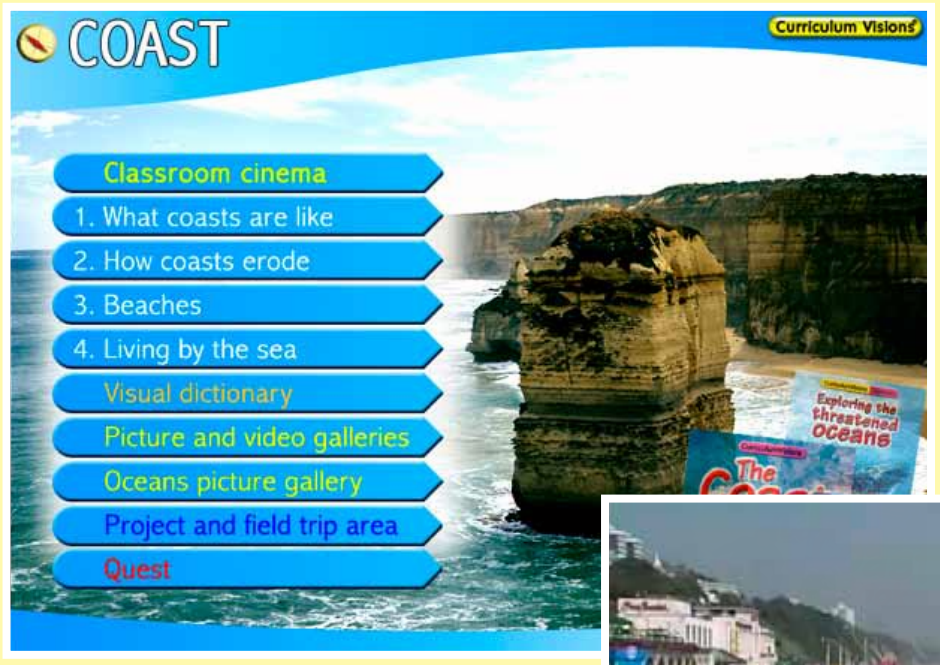
Our Learning Centre at
**www.curriculumvisions.com**
has almost everything you need to teach your primary curriculum in one convenient Virtual Learning Environment.


You can use support videos, e-books, picture and video galleries, plus additional Creative Topic books, graphic books called Storyboards, and workbooks. Together they cover all major curriculum areas.

All topics are easily accessible, and there is a built-in context search across all media.

You can also use our printed student books online as part of your subscription to the Learning Centre. There page-turning versions of every printed Curriculum Visions book for use on your whiteboard.

▼ The Coast home screen




▲ 'Classroom cinema' video


▲ Web site page

▶ Web site caption

Please note: screens are subject to change from those shown here.

6

The Coast Mini-Movies CD contains information and examples that enhance the topics covered in The Coast Book and provides a virtual field trip experience for a variety of coasts and features. Each mini movie is accompanied by pop-up field notes and a gallery of pictures to copy and paste into projects.


## Matching the curriculum

The curriculum asks that students develop knowledge, skills and understanding relating to people, places and environments at different scales, both at home in the United Kingdom, and overseas.

The Coast Pack provides the foundation for you and your students to investigate how and why physical and human features of coastal environments are arranged, how people and places are linked, and how they relate to the wider world.

As with all parts of the geography curriculum, this book on coastal environments seeks to focus on questions like "What/Where is it?" "What is it like?" "How did it get like this?" "How and why is it changing?"

While covering the subject matter of the curriculum, The Coast Pack also facilitates the development and use of geographical skills.

This pack encourages students to consider their own attitudes and values, and those of other people. It also promotes respect for the environment and people's impact on it.

The pack is fundamentally built around the need to address the ideas of 'The Coast Environment' and 'Understanding People and Places'.

Linked resources

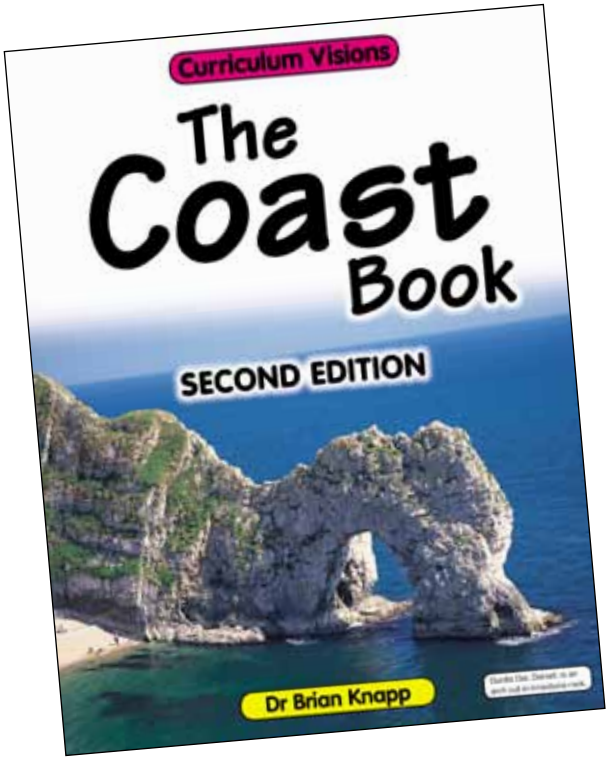
# Section 2: The Coast Book explained

Although the student book – *The Coast Book* – is clear and simple, a great deal of care and thought has been given to the structure and the content of each double-page spread. The worksheets in section 3 of this *Teacher's Guide* also directly link to the pages in *The Coast Book*.

It is possible to use *The Coast Book* and section 3 of the *Teacher's Guide* without reading this section, but we would strongly recommend that you take a short time to familiarise yourself with the construction of the student book.

*The Coast Book* begins with a quick visual introduction to the coastal environment. This is followed by sections on the processes and landforms of the physical environment, and how people live in, and impact on, coastal environments.

It concludes with concepts of how wildlife also shares the coastal environment.




▲ ***The Coast Book* title page.**

## Safety

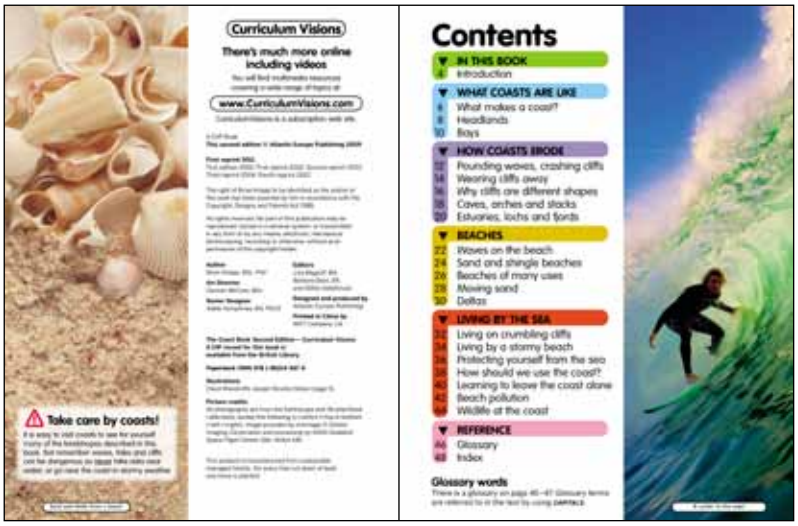
Please note that on page 2 of *The Coast Book* there is a passage about coastal safety.

It is important that students know that coasts are beautiful and exciting environments to be in, both for sport such as sailing, and for recreation such as swimming and sunbathing.

However, it is equally important that students are made aware of the fact that people who are unfamiliar with an environment often unwittingly place themselves in hazardous situations. Indeed, many accidents would not happen if people always took note of the landscape and weather, and avoided danger.

One of the values of geographical studies is to explain, in a very matter-of-fact way, the nature of coastal processes. This enables students to work out for themselves that some parts of the environment are hazardous. If they learn in this way, they may be more careful about putting themselves in situations where they could be at risk from rockfall, strong tides, rip currents, plunging waves and quicksand.

# Contents




The book is organised into chapters and subdivided into double-page spreads. Chapters are shown on the contents page and are colour coded. Matching coloured headers run across each spread. The concept is paralleled by the pages on the web site.

Each spread has a heading, below which is a sentence that sets the scene and draws out the most important theme of the spread. The main text of the page then follows in straightforward, easy-to-follow, double column format.

Words highlighted in bold capitals in the student book are defined in the glossary on pages 46–47. The majority are technical words important to the subject, but some are simply difficult words. The glossary definitions help to reinforce the meaning of a word that may be slightly ambiguous if taken out of context. Many technical words used by geographers are also used in everyday situations where they may have a different meaning.

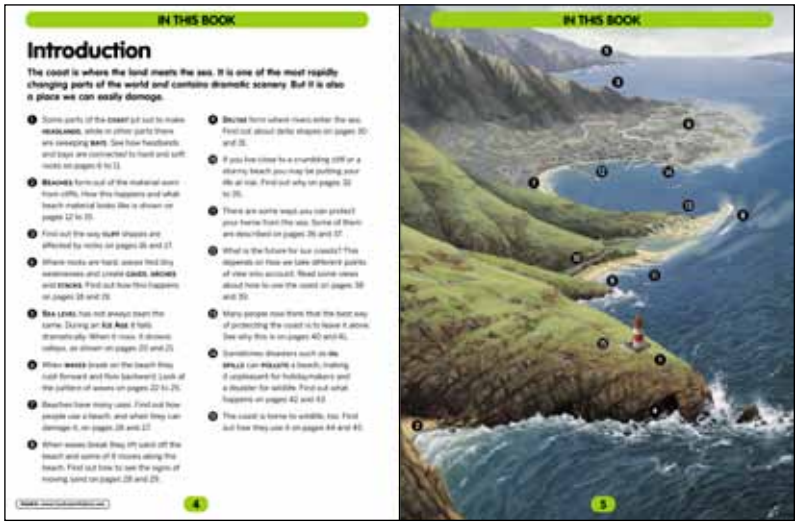
The glossary words are highlighted on the first page where they are encountered. They may be highlighted again on subsequent pages if they are regarded as particularly important to that page or spread.

Please note that case studies have been especially chosen from various parts of the world. Thus, one spread may have examples from the UK, the next may be from Australia and the next from the United States. In this way, students will automatically be exposed to a number of contrasting environments, both at home and abroad. However, it will be especially helpful to remind students to look carefully at the way the pictures and their captions are related to, and often extend, the theme of the spread.

Most captions to photographs give the location of the scene.

# In this book

## Spread 1 (pages 4-5 of The Coast Book)




1

A reproducible worksheet and supporting teacher's notes for this unit are on **pages 38–39** of this book.

### Introduction

This spread provides a summary of coastal environments.

Points 1 to 15 identify landscape features and how people interact with the coastal environment.

Each of these features is linked to:

- A spread further on in the student book.
- Worksheets in section 3 of this *Teacher's Guide.*
- The web site.

The picture on page 5 of the student book (shown above) or the larger version shown on the *Coastal Environments Poster* should be used to reinforce the geographical principles encountered as you go through the book. It also provides a focus for revision at the end.

An annotated version of this picture is given on page 41 of this *Teacher's Guide*.

Many of the words shown on page 4 are highlighted as glossary entries (the meaning of each word will become more apparent when it is encountered on the relevant page later in the context of the supporting explanation and information).

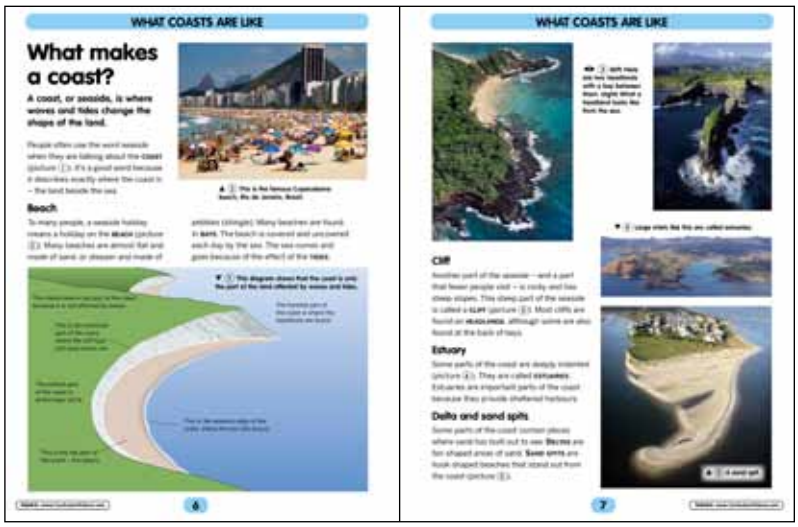
The picture on page 5 shows a landscape of rugged cliffs in the foreground and bays in the distance. You should notice that when cliffs stand out to sea they make headlands. Headlands get the full force of the wind and waves and so the conditions can be very stormy. Notice that there is no obvious shelter here for boats, while the windy cliffs are too exposed for comfortable living and so there are no houses.

In between the headlands there are bays. In this drawing, the main bay has a river flowing into it and the material deposited from the river has spread out to form a fan-shape called a delta. Bays are much easier places for people to live in and so most towns and cities are here.

# Chapter 1: What coasts are like

The material in these three spreads is fundamental to an understanding of all the aspects of coastal environments that will be covered later on.

## Spread 2 (pages 6-7 of The Coast Book)




2

Reproducible worksheets and supporting teacher's notes for this unit are on **pages 40–45** of this book.

### What makes a coast?

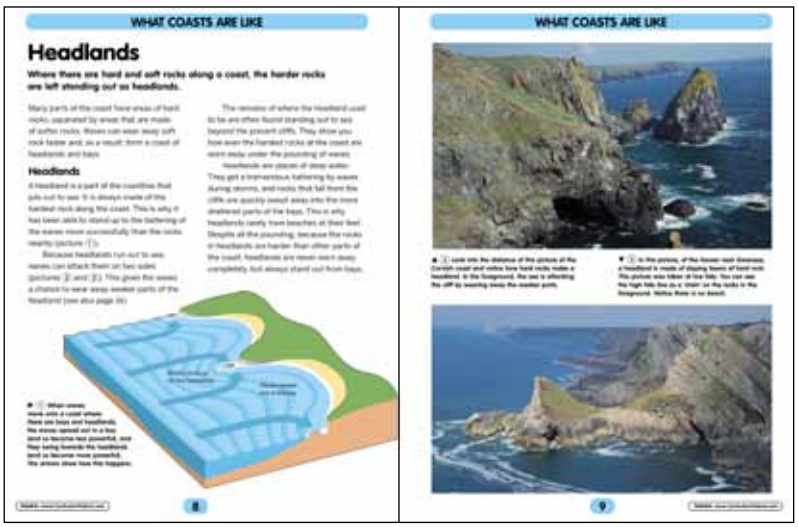
This spread explains what coasts are and gives the fundamental definitions of the major coastal features. The coast is separated into beach, cliff, delta and estuary, and these sections feature individually in later chapters. The separation into major elements allows pupils to begin to simplify the complex coastal environment.

The beach is described in terms of having a variety of sediment sizes, and being as much a feature of the tides as of the material.

Even at this early stage, the fact that beaches are found in bays is given emphasis. In a bay and headland environment, which is found around the majority of the UK coast (and which is discussed beginning on page 8), the headlands are dominated by cliffs. (Note: in some places, for example the eastern part of England south of Flamborough Head, there are no bays and headlands in the traditional sense because the coast is masked with glacial materials of relatively uniform resistance. In these cases the open shore is fringed entirely by low cliffs.)

Coasts are often not very accurately represented on atlas maps, and for this reason a satellite picture is used to show some coastal features in plan. The area close to Sydney shown in the photo has many of the coastal features mentioned on this spread.

# Spread 3 (pages 8–9 of The Coast Book)




3

A reproducible worksheet and supporting teacher's notes for this unit are on **pages 46–47** of this book.

## Headlands

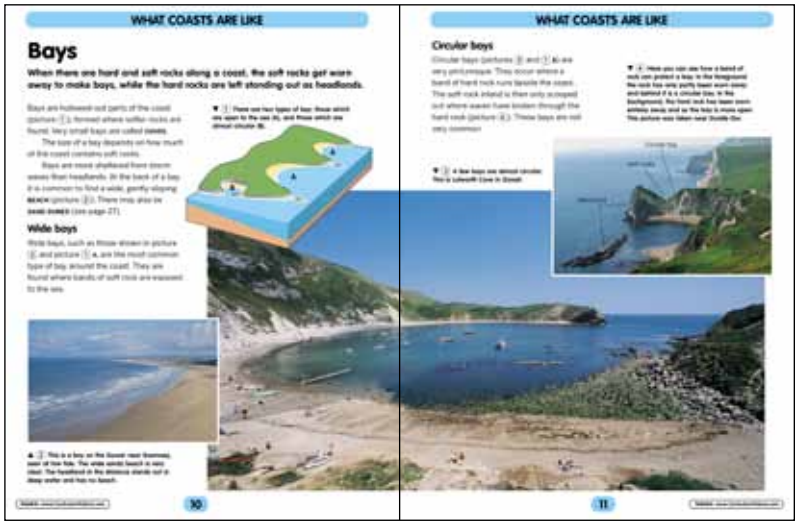
This spread focuses on one of the most dramatic parts of the coast – the headland. Headlands are introduced as being made of harder rock than elsewhere along the coast. They are also described as a part of the bay and headland pattern of many coasts. (Note that cliff profiles are dealt with separately on page 16.)

Headlands are subject to concentrated wave attack. Students can check this for themselves on a field trip by noticing that no matter what the weather, the waves striking a headland are always larger than those in a bay. The reason for this is shown in the diagram. Waves are altered in shape as they approach the coast, curving into the bays. This focuses waves onto the headlands and so makes waves on headlands higher, while the waves entering the bay spread out to fit around the bay and are therefore lower.

More able children may notice that the arrows have been drawn equally spaced out at sea. This means that each part of the wave has the same amount of energy when out at sea. Where the centre arrows converge on the headland, the arrows are closer together, showing that energy is concentrated (and so the waves are higher). In the bays the arrows splay out, showing that the energy is spread out and the waves are lower. It is for this reason that the erosion of the headlands and the soft bay rocks keep in step; the rocks on the headland are harder than those in the bay, but the waves striking the headland are more powerful.

The pictures in this spread can be used to help children begin to identify that different kinds of rocks give landscapes of different shapes. The upper picture on page 9 is an igneous rock, whereas the lower picture is of a steeply dipping sedimentary (limestone) rock.

# Spread 4 (pages 10–11 of The Coast Book)




4

A reproducible worksheet and supporting teacher's notes for this unit are on **pages 48–49** of this book.

## Bays

Bays can be contrasted to headlands in so far as they contain softer rocks.

Bays are generally curved. Wide bays are half-moon, or crescent, shaped. The most tightly curved part of the bay normally lies in the direction of the prevailing wind. In its shelter are the finest sediments, such as fine sands. As you go around a bay of this kind the beach material is more exposed to the prevailing wind and tends to be coarser. In the most exposed part of the bay the material may be gravel, or even shingle. You can test this idea on a field trip with a simple survey.

Wide, crescent-shaped bays occur in places where the bands of rock reach the sea at an angle. The width of the bay is determined by the relative widths of the soft bay and hard headland rocks.

Bays may have cliffs behind them if the coast is retreating rapidly, or they may be backed by sand dunes if the coast is relatively stable. Again, this could be checked by survey on a field trip.

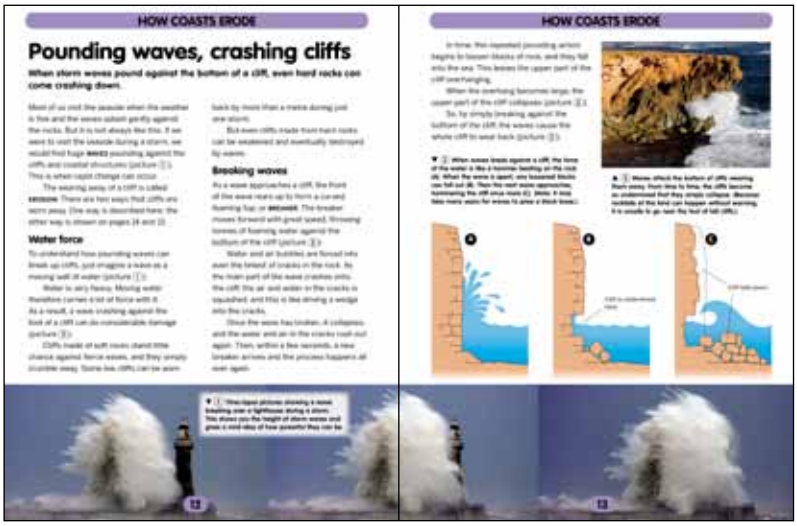
Some bays, of which the most well known is probably Lulworth Cove, shown as a picture on pages 10 and 11, are almost circular. The usual reason for this is that the rocks are, coincidentally, parallel with the coast. When this happens the waves can break through, or breach, a hard rock band, allowing the sea access to the soft rock that lies inland of it. Because the entrance breach is narrow, the shape of the bay is determined by how far the waves can fall out through the breach. In the case of Lulworth Cove, the breached rock is limestone, while the soft rocks are weak sandstones and muds. The rock at the back of the bay is another constraining factor. In this case it is a massive wall of chalk.

The picture of a small bay to the west of Lulworth (Picture 4) shows how bays change as erosion proceeds. In the foreground there are two breaches and not much left of the limestone. As a result there are two small circular bays side by side. In the distance the limestone is completely missing and circular bays do not form at all.

# Chapter 2: How coasts erode

Having briefly explained the main large-scale features of the coast, the next stage is to explain how they are sculpted by the forces of the sea. The next spreads concentrate on the work of waves, both the direct force of water and the effect of the sediment carried in the breaking waves.

## Spread 5 (pages 12–13 of The Coast Book)




5

Reproducible worksheets and supporting teacher's notes for this unit are on **pages 50–55** of this book.

### Pounding waves, crashing cliffs

The sea is a very powerful eroding agent, it can wear away rocks relatively quickly. In areas with low cliffs and soft rocks, such as Lincolnshire, it is not uncommon to find places where the retreat is a metre or more per year.

Notice that the retreat depends on the hardness of the rock and the height of the cliffs. The taller the cliffs, the greater the volume of material that has to be removed for each metre the coast retreats.

If you want to show spectacular retreat, choose places for fieldwork that are exposed, have low cliffs and are made of soft rocks. Christchurch Bay, Hampshire, and most of the East Anglia and Lincolnshire coast are examples.

Students need to be made aware that there are two causes for coastal erosion: the power of the water alone, and the effect of pebbles and sand carried by the waves. The effect of water is dealt with in this spread, and the effect of sand and pebbles on page 14.

Waves in deep water do not carry sediment. So, in general, deep water off cliffs are places where wave action alone is responsible for cliff retreat. Pupils will need to consider two things (which they may also learn as part of the Forces unit in the science curriculum): the water in a wave moves quickly, and water is heavy. If children were to accidentally drop a bucket of water on their toes they would agree that it would hurt far more than if they placed a bucket of water there carefully. So speed and weight are both important.

Erosion is like a pneumatic hammer (used to dig up streets), which is designed

to be heavy and to jump up and down on the road surface. This repeated falling motion soon loosens even concrete. Now get children to imagine this action turned on its side, and they have a good idea of how a wave works.

Waves can be made even more effective if the rock contains cracks. Water and air can be forced into even tiny cracks as a wave hits a cliff, and this produces compression, a powerful force. Once the wave's energy is spent, the air escapes from the crack and the pressure reduces. Thus there is a repeated pumping action into cracks as well. The result is to cause rocks to break loose – it is a kind of rock fatigue analogous to metal fatigue.

Now also remember that waves only work between high and low tide. All of the action therefore occurs at the bottom of a cliff. The upper part of the cliff is unaffected. Cliffs retreat by collapse when the undercut base of the cliff causes the upper part to fall under its own unsupported weight.

The actual moment of collapse is unpredictable and may occur at a time other than when the waves are breaking. This is why tall undercut cliffs are potentially dangerous and not a good place to stop for a packed lunch. Piles of boulders and recently fallen rock at the base of a cliff are signs of instability and children should look out for them.

# Spread 6 (pages 14–15 of The Coast Book)


6

A reproducible worksheet and supporting teacher's notes for this unit are on **pages 56–57** of this book.

## Wearing cliffs away

These pages deal with the second way in which waves cause cliffs to be worn away – through the sandpapering action of waves carrying sand and pebbles.

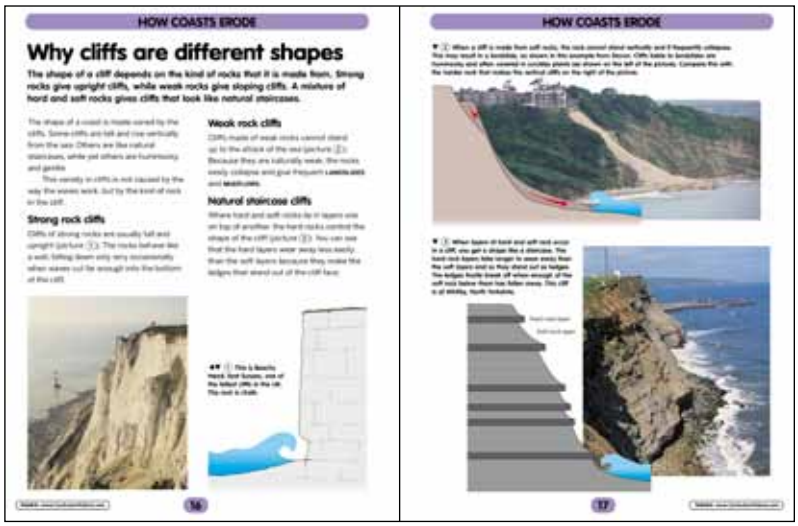
For waves to carry sediment the water has to be shallow and the waves have to break over a beach. This type of action therefore tends to occur at the back of a bay rather than on a headland.

You can tell which kind of action may be more important by looking at the cliff. If the cliff base has rounded rocks, then abrasion by sand and pebbles is probably most important. If the cliff face is still fresh and angular, then the pounding effect of the waves (page 12) will probably be more important.

One of the most noticeable features of a cliff subject to abrasion is a cliff notch. However, deep notches are not very common. The notch in the chalk shown in picture 3 on page 15 is well developed because chalk is quite a soft rock and easily worn back by abrasion. In hard rock areas a definite notch may be less easy to spot (and therefore not guaranteed to be found on a field trip!).

You can use this opportunity to remind children that when pebbles and sand get thrown against a cliff, they are also worn down, because all of the rock material is often of a similar hardness (cross reference to the Materials unit in the science curriculum).

# Spread 7 (pages 16–17 of The Coast Book)




7

Reproducible worksheets and supporting teacher's notes for this unit are on **pages 58–61** of this book.

## Why cliffs are different shapes

In the previous spreads we have examined processes at work in erosion. In this final spread on cliffs, we can ask children to try to understand why cliffs are different shapes, and in so doing make more of the fact that the materials of cliffs vary considerably.

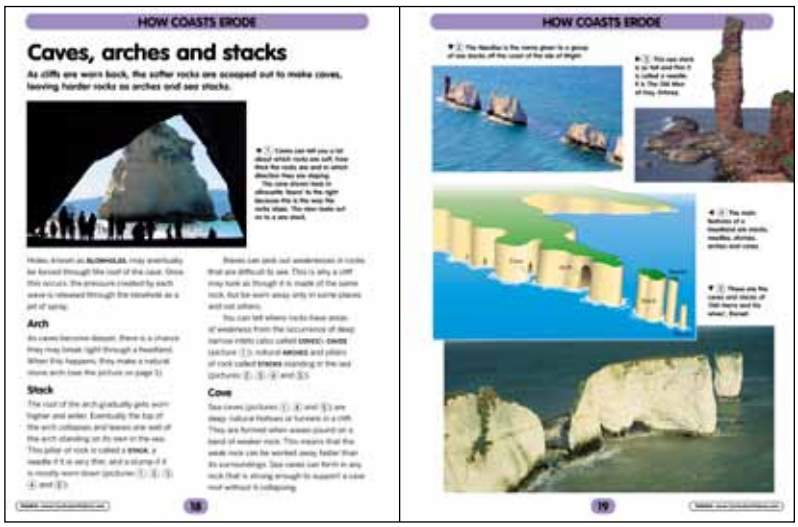
Part of this spread is to review the subject matter learned in the previous pages. Thus they should notice the undercutting of a tall cliff. Tall cliffs are made of rock that is either almost entirely fused together (as is the case for igneous rocks like granite, or those that formed under pressure, like serpentine) or they are made of rocks that behave like a wall of bricks (as is the case for hard sedimentary rocks such as limestone and hard sandstone).

In cliffs made out of weak material, such as boulder clay, rainwater often gets into the rock, and this tends to add internal pressure to the rock. You can think of rainwater saturating soft rock as similar to putting the soft rock in a bath. The water tends to buoy up all of the particles and so they rest less heavily on each other. With less pressure on the material, it will more readily slide or flow.

In most cases a landslide begins as a slump of material. The slump sends shock waves through the material that shake the particles apart. After that, the particles can behave more like a liquid and flow as 'mudflow'. (This again is covered in the Materials units of the science curriculum – solids and liquids.)

Many cliffs are formed in layered rock (Picture 3 from Whitby). In this case the layers are all flat. The soft material slumps and flows away, leaving the hard layers standing proud as ledges, the end result being a natural staircase. Asking children to draw a cliff of this kind can get them to focus on just how many different layers there are. They should be asked to label both hard and soft rocks (and, if on a field trip, to collect samples of different types of rock from the bottom of a cliff and then rub each one to compare its hardness).

# Spread 8 (pages 18–19 of The Coast Book)




8

A reproducible worksheet and supporting teacher's notes for this unit are on **pages 62–63** of this book.

## Caves, arches and stacks

Few cliffs are made of a uniform material, and the sea often exploits unseen differences in weakness to make a cliff irregular. When this happens caves, arches and stacks form.

Children can use their knowledge of how waves break on cliffs and the effect of different types of rock, learned on previous spreads, to see how caves might form.

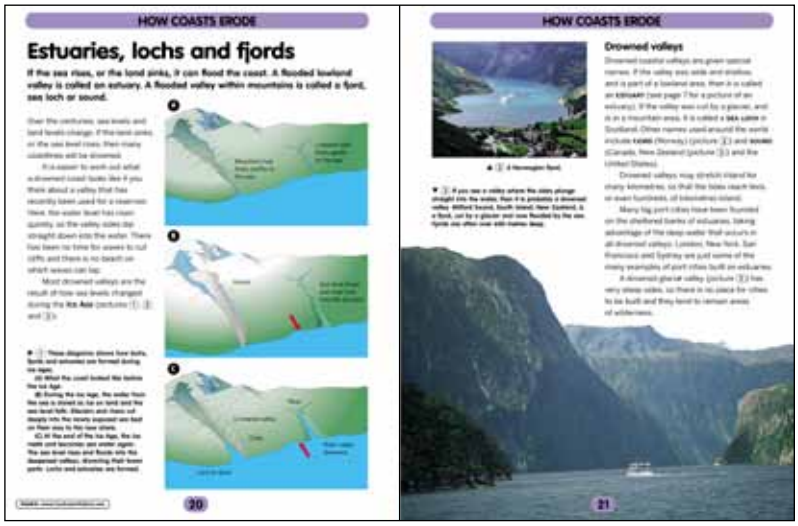
In general, children should look for lines of weakness to explain the formation of a cave. The shape of the cave can give a clue as to the line of weakness. Picture 1, for example, shows a cave sloping up to the right hand side of the picture. Children should notice how this is related to the bands of rock high up the cliff. They can then contrast it to the much rounder cave nearby which has been formed in a thick bed of rock.

Caves are common features of hard rock coasts. They rarely form in soft rock coasts because the rock cannot support a cave.

When caves form in headlands there is the chance that a cave will be excavated right through the headland or that two caves being excavated from opposite sides will meet. When this happens an arch is formed. Arches are not very common, but where they occur they give spectacular landforms.

If the roof of an arch collapses, the result is to leave a seaward pillar of rock, known as a stack. As the stack is further eroded it becomes a needle, and then a stump. Looking at stacks and arches is a good way of demonstrating that the coast is retreating.

# Spread 9 (pages 20–21 of The Coast Book)




9

A reproducible worksheet and supporting teacher's notes for this unit are on **pages 64–65** of this book.

## Estuaries, lochs and fjords

This is a more difficult topic because it requires children to understand that not all of the features of a coast are made by waves.

A discussion of estuaries (drowned river valleys in a landscape of low hills) and lochs and fjords (drowned glacial valleys in mountainous regions) could follow from asking how it is that waves are able to cut so far into the land when the bays they have seen on previous spreads are wide and shallow.

The diagram sequence in Picture 1 shows how a fjord or sea loch is formed during the Ice Age. Children will need to be asked to imagine a time when it was cold and ice sheets formed on the land. Where did all the ice come from? From water in clouds. And where did the water come from? The oceans. And as it was locked as ice and couldn't flow back to the sea, what happened to the sea? The level fell.

When sea levels fall any remaining rivers will cut down to the new level. As glaciers spread out they will also cut down into the newly exposed land. In both cases the valleys will extend farther out to sea and be deeper than before the Ice Age.

When the ice finally melts, the sea level will rise and flood, and any valleys deepened in the Ice Age will be flooded.

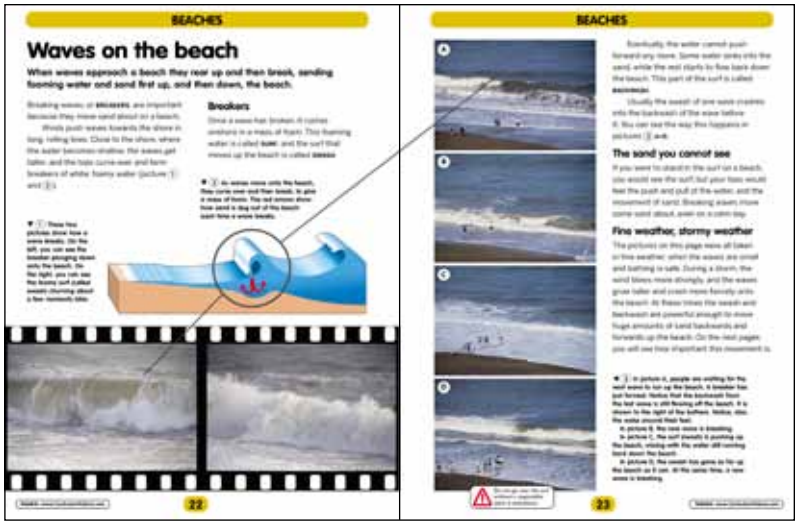
The fact that we have so many estuaries and other drowned valleys around the UK coasts shows that this was a common pattern for our islands during the Ice Age. It also explains why we have so few deltas (pages 29–30) because a delta requires a shallow, undeepened valley.

The picture of a fjord is from New Zealand. Other examples, including the UK, are given on the web site.

# Chapter 3: Beaches

The five spreads that make up this chapter introduce the interaction of waves with beach materials. Together, they provide opportunity for much modelling in the classroom, as well as fieldwork studies.

## Spread 10 (pages 22-23 of The Coast Book)




10

Reproducible worksheets and supporting teacher's notes for this unit are on **pages 66–69** of this book.

### Waves on the beach

Waves are frequently seen but rarely observed. Thus it is probably true to say that all children will have been to a coast and seen waves breaking, but if asked, almost none will accurately be able to describe what happens as a wave breaks. It is therefore important to spend some time helping children to follow through the breaking of a wave. It is a good exercise in making close observations of a natural phenomenon. Some swimming pools now have wave generating machines, so it may be possible to see waves breaking without having to go all the way to a coast. In such environments children can also safely experience the motion of the water during a breaking wave. Otherwise a wave can be set up in a tank by smacking the water surface with a plank. Beaches can be simulated by filling one end of the tank with sand.

There are four terms to point out: breaker, surf, swash and backwash. Breaker is a wave with a line of foam across it. All of the air-filled water on the beach is surf. The air bubbles in the water make it white. The water rushing up the beach is swash, the water returning down the beach when the wave energy is spent is the backwash.

One good way to help children remember this is to get them all to say the words swash and backwash out loud as though they were the surf. They need to say swash, then backwash, about 8 or 9 times a minute to get into the swing of the waves. (Storm waves are a bit more frequent, swell waves of summer a bit less frequent. Finding out how many waves break in a minute is a good fieldwork exercise.) Get children to try to imitate a wave as they say the words out loud.

Waves break forwards on the beach when the weather is fine and the waves break on a gently sloping beach. These waves push more material up the beach in their swash than they drag back in their backwash. In general all waves on gently sloping beaches will push material up the beach, which is why they are safe for bathing. Steeper beaches have a more powerful backwash, particularly during a storm, when the waves break more or less vertically on the beach. Steeply sloping beaches have strong backwash, even in fine weather. In times of stormy weather, the backwash can be ferocious and can concentrate itself into places of very fast moving water called rip currents. If people bathe in such places there is a real risk of being carried out to sea. In general, therefore, bathing on any steep beach is a risky business. Children should be made aware of this.

The reason backwash varies is entirely because of the steepness of the beach. The steeper the beach, the faster the water can flow back and the less of it seeps into the beach.

Feeling swash and backwash is an entirely safe thing to do on gentle beaches and in calm conditions. There is still enough action in the sand for the effects of water to be felt. Children can also watch sediment being carried back and forth between their toes and around their feet. This is a good fieldwork exercise.

However, it is not good practice to try this on a steep beach, in stormy weather or where there is shingle and where the swash and backwash make it much easier for children to lose their footing and fall into the surf.

# Spread 11 (pages 24–25 of The Coast Book)


11

A reproducible worksheet and supporting teacher's notes for this unit are on **pages 70–71** of this book.

## Sand and shingle beaches

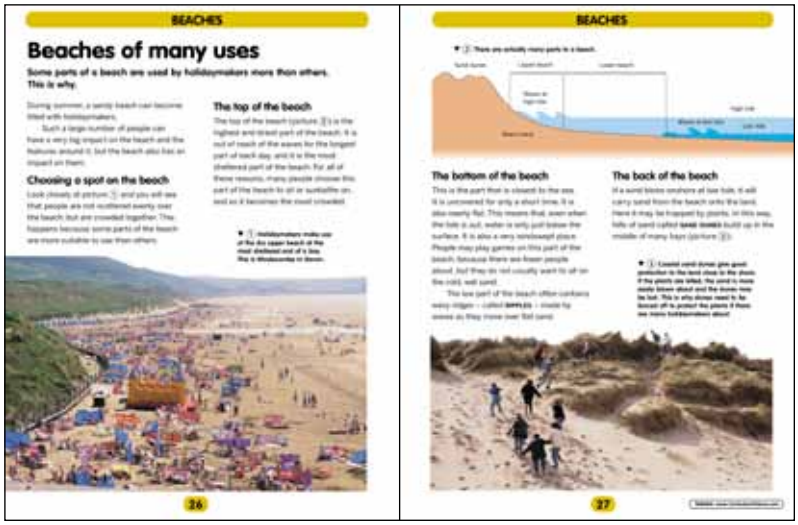
On the previous spread children were invited to think about the rhythm of surf swashing in and backwashing out. Once they have the rhythm in mind, they can begin to think about its effects. By showing them some photographs, such as those on page 24, it is quickly made clear that beaches can vary a lot and that some beaches are steep, while others are gentle. At the same time they can see a correlation between steepness and the size of the beach material. Steep beaches are shingle beaches, whereas gentle beaches are sandy beaches. Some beaches have a steep shingle upper beach and a sandy lower beach. You can discuss with the children whether they like shingle beaches, all sandy beaches, or a beach which is only sandy at low tide.

(Historical note: In the past, when travel was much more limited, the majority of people went on holiday to the beach that was nearest by train. In some places the nearest beach was not particularly suitable for swimming or sunbathing because it was steep and shingly. However, seaside resorts developed at such places anyway, because less people used the beach than in current times and promenading was as important as sunbathing. This meant that some seaside resorts had a problem as soon as transport became easier and people had more choice of location. Those with less suitable beaches soon found the holiday trade slackening off. Climatic factors have had a drastic effect now that people can choose sandy beaches in places with warm, sunny climates as opposed to the unreliability of the British weather.)

There are not many muddy beaches around our coasts because mud is so fine it will not easily settle under wave action. Mud tends to be found in estuaries. In fact, it occurs here not just because estuaries are sheltered, but because there is a special chemical reaction between the mud being carried by the river waters and the salty sea water. This results in the mud particles clumping together and so settling out. And once the mud has settled, it sticks to other mud and is very smooth, so it is very difficult for currents to pick it up again. It may even be further stabilised by colonisation by plants.

It might be worth mentioning the hazards of walking onto muds and quicksand. The hazards of quicksand are shown in one of the demonstrations in the photocopiable worksheets.

# Spread 12 (pages 26–27 of The Coast Book)




12

A reproducible worksheet and supporting teacher's notes for this unit are on **pages 72–73** of this book.

## Beaches of many uses

On this spread some of the features that have been mentioned on previous spreads are drawn together and turned into an explanation of why and how beaches are used.

Children may not have noticed that beaches are not used uniformly, at least not those that form part of a beach and headland environment. So the first thing you may care to do is to get them to look at page 26 and notice how many more people there are on the left than on the right and how many more there are in the foreground than in the background. The purpose of the spread is to try to work out why this is so.

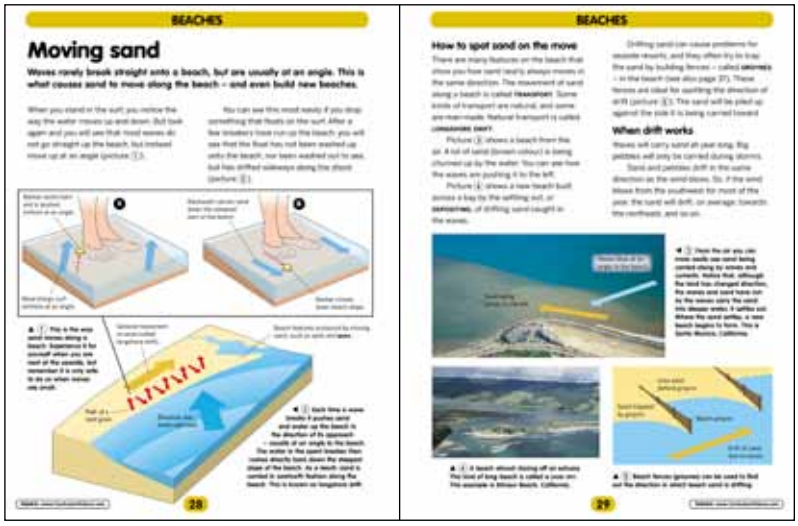
In this spread we are bringing together physical and human geography. For example, we now know that some parts of a beach may be flatter and sandier than others. The beach is not like a rocky coast, keeping water at bay. There is water in the beach sand underneath where everyone is bathing, even at the top of the beach. Wherever you are on a beach you can dig down and find wetter sand, and eventually a pool of water. The level of water in the pool represents the level of the water table in the beach, and this rises and falls with the tide. The upper part of the beach drains first and this gives time for the wind and sunshine to dry out the sand and make it nice to sit on. The lower part of the beach is drained last and really never dries out. However, damp sand is firmer than dry sand (due to the surface tension effect of water – see Forces in the science curriculum) and so it is a better place for playing games. The dry sand on the upper part of the beach is too soft for games that need a ball rolled along the ground or for people to run about. So the beach provides two different kinds of environment which people choose for sunbathing and playing on. Their choice may be quite unconscious, but the photograph shows that they all follow the same pattern.

As well as the physical nature of the sand, there is also the onshore, or prevailing, winds to think about. Get children to look at the picture and find out if the windbreaks are arranged in a similar direction. If they are it suggests that they are there to keep off a chill wind. If the windbreaks are facing the sea, then it may be either a prevailing wind or a sea breeze that is the problem, but if the windbreaks are at any other angle then it is almost surely against a prevailing wind. If the windbreaks are randomly arranged, then it suggests there is no special wind direction and the windbreaks are just being used for privacy reasons.

Finally, you might care to discuss with children the effect of convenience. The car access and car park are behind the photographer. Beach gear is quite heavy and so most people prefer not to carry it too far. This also explains why most people gather in one part of the bay. Furthermore, people like to gather near where there are toilets, food stores, and so on. Children might like to make a list of these while doing fieldwork.

Notice that the back of this beach is fenced off. It consists of sand dunes. Sand dunes are good fun to play on, but heavy use causes the marram grass to break down and the dunes to erode. The dunes in the distance are not fenced off in the same way as those in the foreground because the pressure from trampling is less.

# Spread 13 (pages 28-29 of The Coast Book)




13

A reproducible worksheet and supporting teacher's notes for this unit are on **pages 74–75** of this book.

## Moving sand

The idea that sand moves along the shore is more complex than the idea that it moves up and down. Yet the sideways, or longshore, movement of sand is the most important factor in affecting the shape of the coast. This topic is best dealt with by the more able, or possibly after a field trip, when the physical reality of the movement is clear.

The place to begin from a practical point of view is with the observation of the way waves push up a beach. This can be seen from the photographs on page 22 of the student book, but the angle is slight. As with many coastal processes, it is not so much the drama of a single event, but the repetition of the process which causes the effect.

When swash moves up a beach it is usually at an angle. So, in fact, the sand moves with the swash up and across the beach. The diagram shows this in exaggerated form. The swash is driven onto the shore in the direction given to it by the prevailing wind. On the other hand, when the swash is spent, the water is then acted on by gravity, and so the backwash runs down the line of the steepest slope, which is at right angles to the beach. As a result, the water does not return to its original position, but moves along the beach.

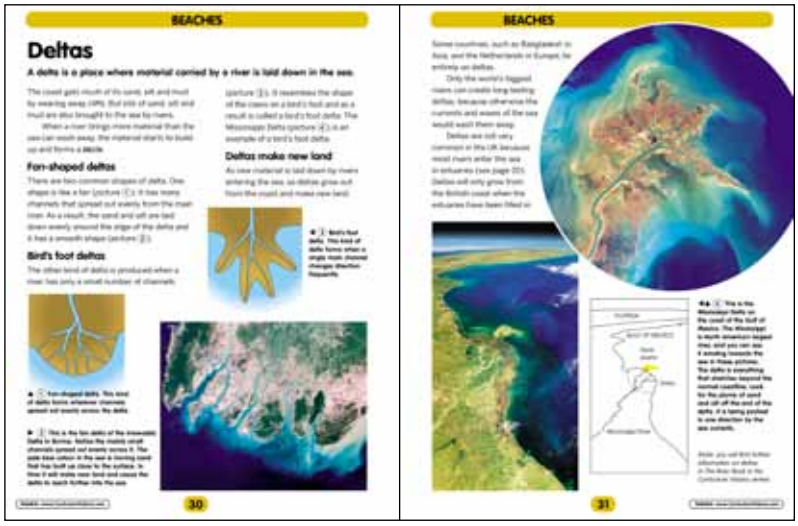
Because the water carries sand, the sand moves with it.

During a field trip, small balls and feet all show the effect when standing in the surf. (Note: if you are doing fieldwork that requires standing in the surf, do the swash/backwash part first (page 23 of this guide), and then do the longshore drift part on another day, or at least at a different time of the same day, when there has been time for the simple swash/backwash idea to become meaningful. Combining an explanation of swash/backwash and longshore drift is often confusing for the less able.)

On this spread we are confining ourselves to the physical effect, not the human effects, so although we look at beach groynes we are simply saying, "look at these fences and notice how they show that sand is moving because it has been built up more on one side than the other". We are not taking the next step of saying that the groynes are there for a purpose. This is dealt with on page 37.

Once the idea of the sawtooth movement of sand along a beach has been established, you may want to go on to look at the results. The web site gives pictures of many of the features that are produced, such as spits and bars.

# Spread 14 (pages 30–31 of The Coast Book)




14

A reproducible worksheet and supporting teacher's notes for this unit are on **pages 76–77** of this book.

## Deltas

Deltas are places where river and coastal processes interact, so this topic can be covered in River or Coasts or both. The principle shown here is the same as in *The River Book*, but the examples are different.

Deltas are common in parts of the world where rivers are heavily sediment-laden. They are not very common around the shores of the UK. Rivers that produce enormous amounts of sediment include the Mississippi, featured on page 31. A sketch map alongside the main satellite picture will help children to see how to produce simplified drawings of a landscape. You may wish to help children to see how the delta sticks out from the coast. Notice also that this picture looks east, so the land in the distance is Florida. You can help children to see this by turning round an atlas map for them.

One especially prominent feature of the Mississippi delta is the sediment plume that comes from the end of the delta. Notice that it turns to the right. Notice also the greenish colour of the Gulf of Mexico off the delta, indicating shallow water and more sediment. In this case the satellite allows us to see just what is happening to the material that doesn't settle on the delta.

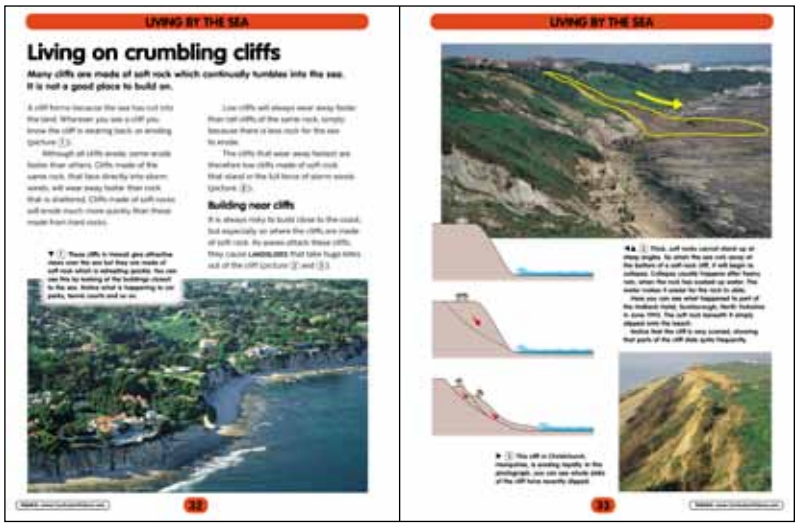
The Mississippi is an example of a bird's foot delta, but the other main form of delta – the fan delta – is also shown. The example chosen is the River Niger. Here there are many evenly-sized channels (distributaries) and so they carry sediment to the sea at about the same rate. The Nile is another such example. The Niger delta is huge. You could consider asking the children to measure it on an atlas.

If you want to develop this theme to include people/landscape interaction, then use the Ganges/Brahmaputra as an example, for here you can find Bangladesh, a country almost entirely on the delta and so on low-lying land. Bangladesh is also at the apex of a funnel-shaped part of the coast and tropical storms push ocean waters towards it, so raising the level of the water and flooding up to a third of the country. Pictures of the Bangladesh delta are on the web site and *The River and Water CD*.

# Chapter 4: Living by the sea

This chapter concentrates on the way that people interact with the coastal environment. The spreads in this section begin with the concept of protecting the coast from erosion, then move on to pollution and finally consider our impact on wildlife (where there is an overlap with the science curriculum).

# Spread 15 (pages 32–33 of The Coast Book)




15

A reproducible worksheet and supporting teacher's notes for this unit are on **pages 78–79** of this book.

## Living on crumbling cliffs

This first spread in the chapter introduces the way in which the sea can erode the land through some dramatic examples, two from the UK and one from overseas. More examples are given on the web site.

The basic concept is that waves erode (wear back, or cause to retreat) the cliff. There are two concepts involved: the fact that waves erode the cliffs at their base; and that the rate of erosion depends on the energy in the waves, the hardness of the rock and the height of the cliff.

This last point means that tall cliffs erode more slowly than low cliffs of the same rock attacked by the same waves. The waves undercut the cliffs in the same way, but once the cliff has collapsed, a lot more material will fall to the beach and need removing by the waves in front of a tall cliff than a low cliff. Thus the volume of material removed will be the same, but cliff collapse from a tall cliff produces more volume of material per collapse and it takes longer to clear away before more cliff retreat can take place.

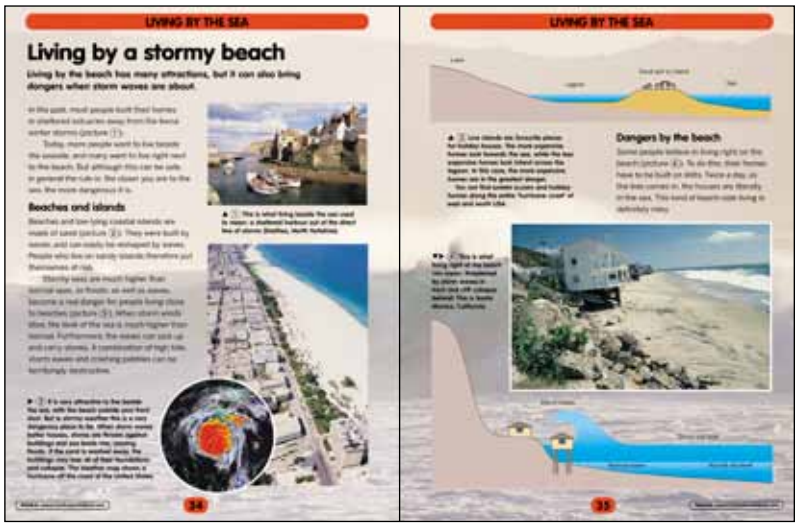
Cliffs are made from two types of materials: those that behave as though they were a pile of bricks, and that are eroded by rockfalls, maintaining their vertical cliff face all the time (Picture 1); and those that cannot stand vertically, because the material is weak (Picture 2). They collapse quite frequently, such as is the case with cliffs of glacial materials (such as the boulder clay cliffs around much of the UK coast) and where poorly cemented sandstone and muds occur (for example, in the Hampshire basin).

Landslides are failures of sections of intact cliff. Such failures mainly happen in chunks that slip down and also rotate a little, leaving the former cliff top as a ledge a little way down the cliff (Picture 3). Mudflows are of saturated mud. In these cases the material flows down onto the beach and the entire flow is a jumbled mass of material (Picture 2).

People who live near such cliffs are in severe danger. The weight of buildings on the cliff edge can be a contributing factor, but more important in the case of landslips and mudflows is a period of heavy rain to saturate the material of the cliff. Building or not, this type of cliff regularly collapses.

Children could be asked to look carefully at Picture 1 and describe what they think will tumble into the sea next. Ask them if there are signs that a collapse has just occurred (in which case there would be material on the beach) or whether a collapse is due (in which case the beach will be clear).

# Spread 16 (pages 34–35 of The Coast Book)




16

A reproducible worksheet and supporting teacher's notes for this unit are on **pages 80–81** of this book.

## Living by a stormy beach

Although it is often dangerous living by a rapidly eroding cliff, it can be even more hazardous to live by a beach. From earlier pages, children will be aware that only some parts of beaches are at risk, because some parts of bays are naturally sheltered and other parts are places where the sand naturally builds up, providing a natural defence.

People who live by a beach, whether or not it is sheltered from storm waves, are at great risk from flooding by high tides, especially those made even higher by storms. Many homes are now built on salt marsh land that would have provided a flood barrier in the past.

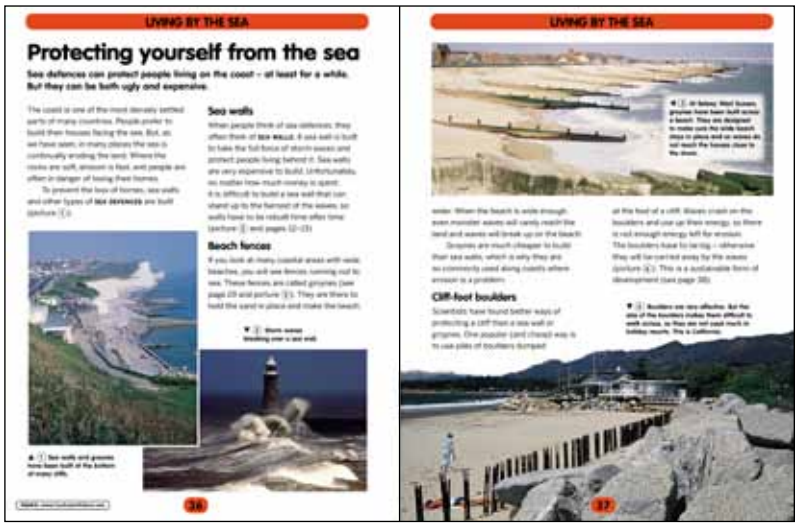
Ask children why people want to live by the beach, and not a few hundred metres or even a kilometre inland.

Beaches in some parts of the world are much more at risk than others. In particular, coasts that are liable to suffer from hurricanes are the most at risk. Storm waves driven by hurricanes can be several metres above normal high tide and the crests of waves over ten metres above normal. These waves (not to mention the accompanying ferocious winds) can crush many dwellings.

Picture 4 gives an opportunity for discussing reasons why people might want to build on stilts above a beach. In fact the houses shown in this picture are at risk not only from storm waves, but also from landslides as the waves erode the base of the cliffs by crashing through the stilts.

Children may be able to comment on the risk of the hotels, guest houses, etc, of places they have been on holiday, or have seen on a field trip.

# Spread 17 (pages 36–37 of The Coast Book)




17

A reproducible worksheet and supporting teacher's notes for this unit are on **pages 82–83** of this book.

## Protecting yourself from the sea

When people find themselves in places where they are at risk from the sea, they naturally look for ways of protecting themselves. This spread should be considered in conjunction with the spreads on pages 38–39 and pages 40–41. Here we look at types of defences, on the other spreads we look at whether defences should be built at all.

This spread considers a number of different types of defence for two possible situations: first that a cliff is being eroded, and second that a beach is losing its sand and therefore becoming less attractive to holidaymakers.

Essentially children should come to realise that most of the energy in a wave is spent on a wide beach, so one way of protecting a coast is to make the beach as wide as possible. This is the purpose of groynes, those incredibly ugly fences that despoil so many beaches.

If beaches cannot be stabilised with groynes, then a sea wall may be built. The purpose of this is simply to bounce back the energy of the wave.

Neither groynes nor sea walls are easy answers. By bouncing back wave energy, the wall simply serves to cause the waves to carry more beach out to sea. Most sea walls are rapidly undermined as a result.

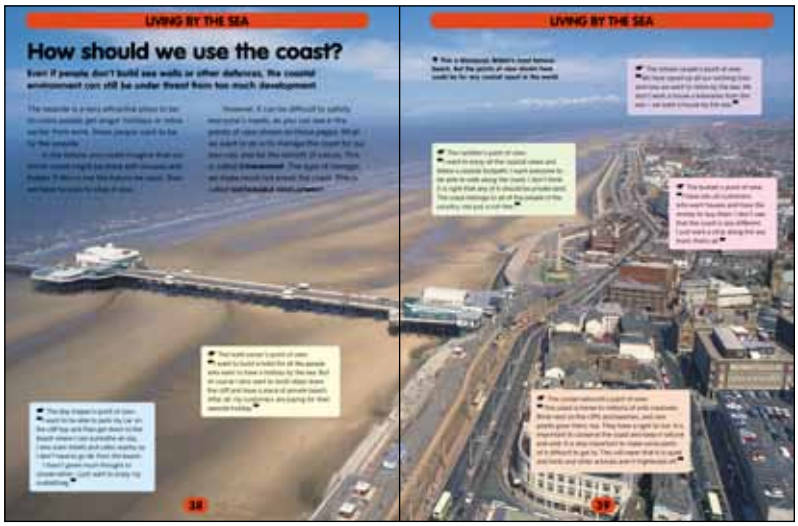
In some places, beaches have to be reinstated by the physically laborious method of dumping sand on the beach. This has to be done time after time forever.

One way of absorbing wave energy is to give the waves something to break up on. This is the purpose of using large boulders placed at the back of a beach. Unfortunately boulders are, in general, no less unsightly than other means of coastal defence.

A further form of protection is to build an offshore barrier island of boulders, leaving the beach in a lagoon behind it.

Children should start to see that all of these forms of defence have disadvantages and that most are very costly, often dearer than the homes, etc, they are designed to protect.

# Spread 18 (pages 38–39 of The Coast Book)




18

A reproducible worksheet and supporting teacher's notes for this unit are on **pages 84–85** of this book.

## How should we use the coast?

Many people want to live by the sea and this is putting the coast (and the people) under threat in many parts of the world. In the UK the pressure is often from retirement homes and resort developments, while in developing countries it may be for making tourist resorts or building onshore shrimp ponds. But whatever the case, there is pressure to develop coastal areas.

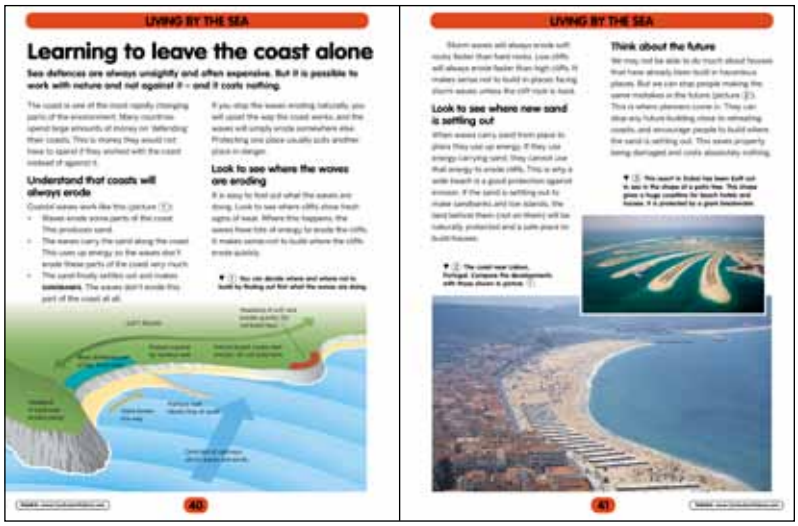
This spread attempts to consider how the development of the coast is a difficult issue and that there is no easy answer that will satisfy everyone. The spread contains a number of statements from people with particular viewpoints, many of which are conflicting. You may wish to get children to consider these viewpoints and compare them with their own views.

One of the main conflicts results from the need of vested interests to make a profit. Everyone has to make a living, so there is nothing particularly wrong with a builder wanting to build, or a hotelier wanting to set up better facilities for their hotel. Similarly, everyone has a right to want to live in a place of their choice, or to enjoy the coast when they have time off.

The coast itself is never static, so trying to protect it in the form we see it today – at an instant of its evolution – is not particularly good conservation sense. This would be like trying to fossilise it. But there is an argument for leaving sufficient amounts of the coastal edge undeveloped so that it can change in a natural way. And if such a strip were public land, then it would satisfy many conservational and leisure demands. However, very little of the coast is public land.

As you can see, whichever way you turn, there is no clear view that can accommodate all concerns. Children might eventually come around to seeing that there is no easy answer to some problems.

# Spread 19 (pages 40–41 of The Coast Book)




19

A reproducible worksheet and supporting teacher's notes for this unit are on **pages 86–87** of this book.

## Learning to leave the coast alone

This spread follows on from the previous spread in trying to find a way forward for the use of the coast. It goes right back to the physical geography and asks: "How is the coast developing naturally?" It then asks, "are there places that can be developed that will not affect the natural coast in any way?"

Children should begin by noticing that the coast is always changing. Nothing will stop this. But it is helpful to know that what is eroded from one place is often deposited nearby. So there are always places building out from the coast to balance those being lost.

If you look around, you begin to see what these are. The places that might be eroding are headlands. But many headlands are built of hard rock and so retreat quite slowly. They can be quite safely built on, especially if a strip of land is left between the developments and the cliff. No views are lost on tall cliffs, and a recreational space is created for all (provided it is a 'soft' recreational space, not 'hard' recreation like a promenade and formal gardens).

Headlands built of soft rock are dangerous places to develop. No new development should be allowed on them and a broad safety zone should be set aside to act as a natural buffer wide enough to last for hundreds of years (and this may mean a zone hundreds of metres wide). If this is done, no sea wall needs to be built below such cliffs and natural erosion can be allowed.

The point here is that it is the material eroded from such cliffs that supplies the sand for the nearby beaches. So if you let the headlands erode, the beaches will not need to be protected by groynes.

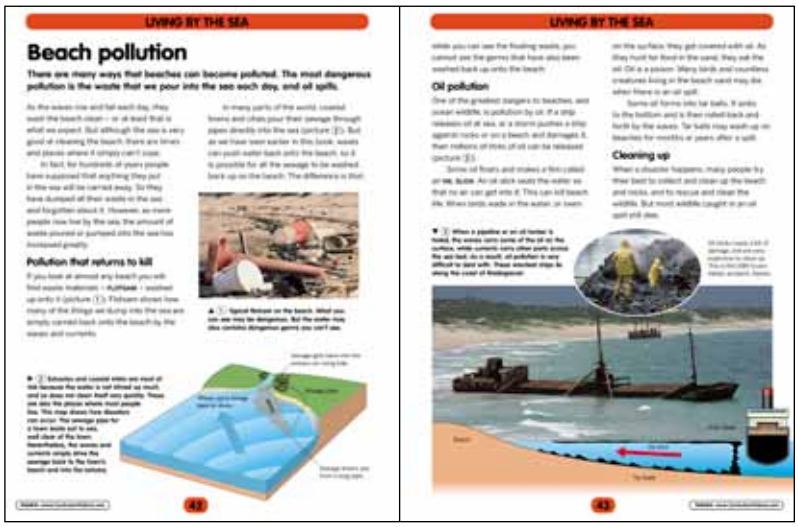
Again, soft rocks in a bay are quite vulnerable and will often retreat faster than a headland because low cliffs have less volume in them. Such areas also need a natural buffer zone in which no building is allowed.

Nothing should be built that stops the free movement of beach sand. If you put in a harbour wall or groynes in one place, you will cause the beach to be washed away somewhere else. All you do is move the problem elsewhere.

But at some places along the coast sand naturally builds up to produce sandbanks such as spits and bars. Because these places are building up, they cannot also be eroding. It could be possible to look at such places as locations for development.

So the answer children might reach is, "don't build at places where material is naturally eroding rapidly; build and develop where material is naturally settling out". This does least damage to the environment and costs nothing.

# Spread 20 (pages 42–43 of The Coast Book)




20

Reproducible worksheets and supporting teacher's notes for this unit are on **pages 88–91** of this book.

## Beach pollution

One of the many problems on a beach is possible pollution.

There are many sources of pollution and some can be investigated on field trips, others through news reports.

Solid material dumped at sea returns to the shore as debris called flotsam. Inevitably much of this material is plastic and so insoluble. It forms an eyesore, and is harmful to wildlife, although not to humans. Some of it is interesting. Oddly-shaped pieces of wood, for example, are used in gardens and for art.

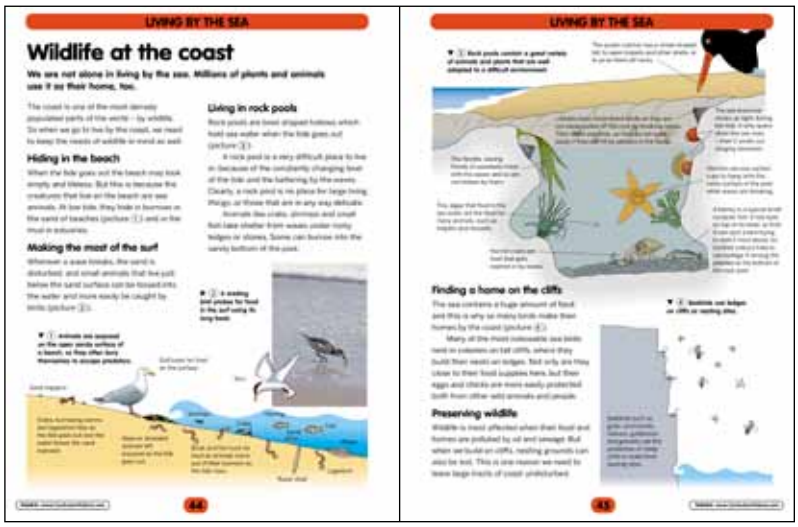
Of more concern is pollution from sewage discharged directly into the sea. Some of this is solid waste, but much is invisible. In the UK the problem is contained around the shore for the most part, but is a widespread health hazard in the developing world.

Oil represents a particular hazard because it consists of insoluble material that adheres to many other substances and coats them. Oil arrives on beaches in two forms, the first is as a liquid that washes up with the waves and coats the beach. This can get down into the sand as backwash seeps into the beach. It is an obvious hazard to wildlife and makes beaches smell awful and be unusable. It may remain on a beach for months or years, which is why oil slicks have to be treated mechanically and with the use of detergents.

When oil spills into the sea some of the heavier parts of the oil form into solids called tar balls which sink to the sea bed and are then brought ashore by currents and waves. These are less harmful than the liquid oil slicks, but can survive on a beach for many years.

Children can investigate signs of oil pollution by looking under stones and examining the soles of their shoes. They can weigh the flotsam found in a short stretch of beach, measure its volume and then predict the size and weight of flotsam on a 10km beach. The results are quite surprising.

# Spread 21 (pages 44–45 of The Coast Book)




21

Reproducible worksheets and supporting teacher's notes for this unit are on **pages 92–95** of this book.

## Wildlife at the coast

The last spread addresses some of the features of wildlife. More on this subject can be found in the Science@School book '6A Adapting and surviving'. The topic overlaps considerably with science and can be treated as a theme on field trips.

Although children may see seagulls and a few other signs of wildlife, they probably do not appreciate the range of species and their distribution.

Starting with seagulls, it might be worth asking if all the birds look the same, or whether some look different, and whether some birds can be found on one part of a beach and some elsewhere. In this way it might be possible to distinguish waders from those that fly over the sea and those whose homes are in cliffs.

The easiest place to find small wildlife is in a rock pool. On a beach, the numerous shells are an indication of life on the beach. It may be worth asking where these animals live, hopefully with the answer that they live in the sand under our feet keeping safe by hiding at low tide.

A collection of shells will give an idea of what might be hiding in the beach. Picture 1 gives an indication of what they might be.

It might be possible to investigate a rock pool and look for some of the creatures shown in Picture 3.

Having appreciated the variety of wildlife and its geographical distribution, it would be appropriate to ask what threats it might face. There are two sources that could be discussed: destruction of habitat by building, and coastal erosion and the effects of oil pollution.

# Reference

The last two pages of the book contain the glossary and the index.

## Glossary (pages 46–47)


The entries in the glossary are listed in alphabetical order. The short definitions are given in simple language for the context in which they are used. They are, therefore, not necessarily the same as definitions given in an encyclopedia or dictionary.

Where necessary, more breadth is given to a definition (to make it encompass other meanings, or make the definition more general).

# Index (page 48)


INDEX

Index

48

A comprehensive index allows specific subjects to be found. To make a search more efficient **bold** page numbers and number ranges are used to indicate where the subject entry has been given special attention.

The index can be used to encourage research skills.

# Section 3: Photocopiable worksheets

## Introduction

The photocopiable worksheets in this *Teacher's Guide* have been designed to be a fast and efficient way of working through the study of *The Coast Book*.

It is intended that you photocopy each worksheet and distribute the photocopies for students to complete. The questions are on all the worksheets.

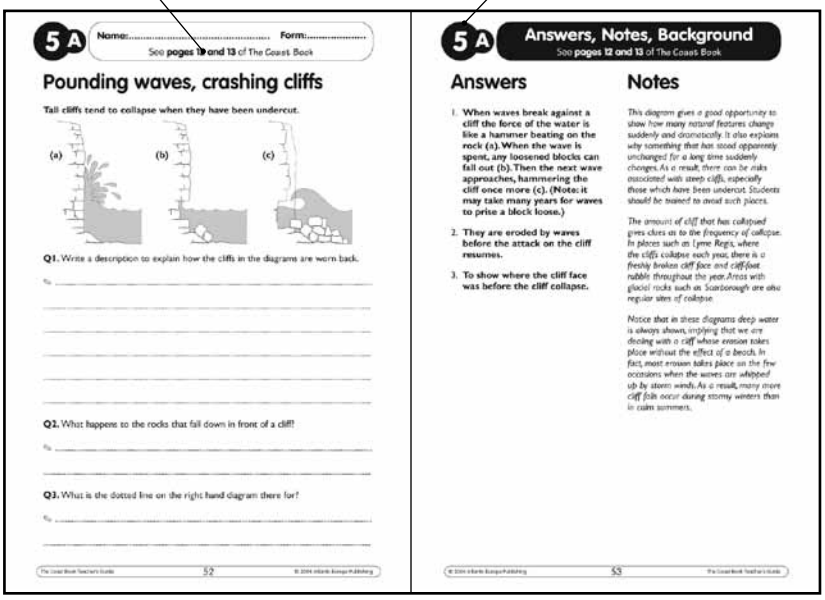
At the head of each worksheet are the relevant pages of *The Coast Book*. 'See pages 8 and 9 of *The Coast Book*', means that the answers to all of the questions can be found by using pages 8 and 9 of the student book. 'Based on pages 8 and 9 of *The Coast Book*' means that the worksheet is more of a practical activity based on the subject in the student book.

Each worksheet has been given a unique number, which is in a circle at the top of the page. If there is more than one worksheet per spread of the student book, then they are labelled **A**, **B**, **C**, etc.

The answers, if appropriate, face each worksheet. Here you will also find additional information that may help in class discussion.

Refers to the page numbers in the student book to which the worksheets relate.

Worksheet number – may be labelled A, B, C, etc.



5 A Name:..... Form:.....

See pages 12 and 13 of The Coast Book

**Pounding waves, crashing cliffs**

Tall cliffs tend to collapse when they have been undercut.

(a) (b) (c)

**Q1.** Write a description to explain how the cliffs in the diagrams are worn back.

**Q2.** What happens to the rocks that fall down in front of a cliff?

**Q3.** What is the dotted line on the right hand diagram there for?

52

5 A **Answers, Notes, Background**

See pages 12 and 13 of The Coast Book

**Answers**

1. When waves break against a cliff the force of the water is like a hammer beating on the rock (a). When the wave is spent, any loosened blocks can fall out (b). Then the next wave approaches, hammering the cliff once more (c). (Note: it may take many years for waves to prise a block loose.)
2. They are eroded by waves before the attack on the cliff resumes.
3. To show where the cliff face was before the cliff collapse.

**Notes**

*This diagram gives a good opportunity to show how many natural features change suddenly and dramatically. It also explains why something that has stood apparently unchanged for a long time suddenly changes. As a result, there can be risks associated with steep cliffs, especially those which have been undercut. Students should be trained to avoid such places.*

*The amount of cliff that has collapsed gives clues as to the frequency of collapse. In places such as Lyme Regis, where the cliffs collapse each year, there is a freshly broken cliff face and cliff-foot rubble throughout the year. Areas with glacial rocks such as Scarborough are also regular sites of collapse.*

*Notice that in these diagrams deep water is always shown, implying that we are dealing with a cliff whose erosion takes place without the effect of a beach. In fact, most erosion takes place on the few occasions when the waves are whipped up by storm winds. As a result, many more cliff falls occur during stormy winters than in calm summers.*

53

The left-hand page is to photocopy and hand out to pupils.

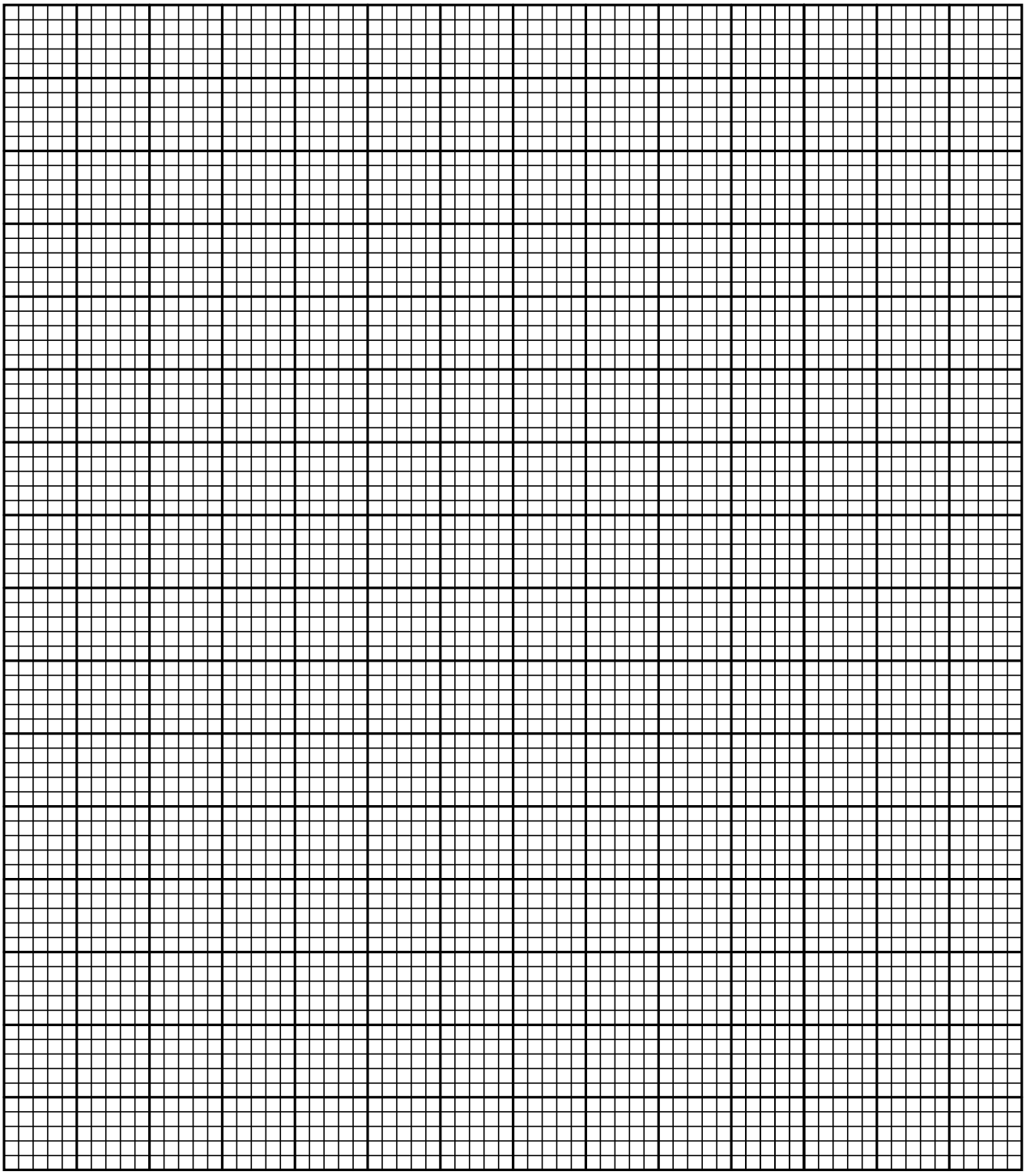
The right-hand page provides the answers and teacher's notes.

# Student instructions

Make sure you write your name and class at the top of each sheet.

✎ This symbol indicates where you should write your answers.

## Graph paper



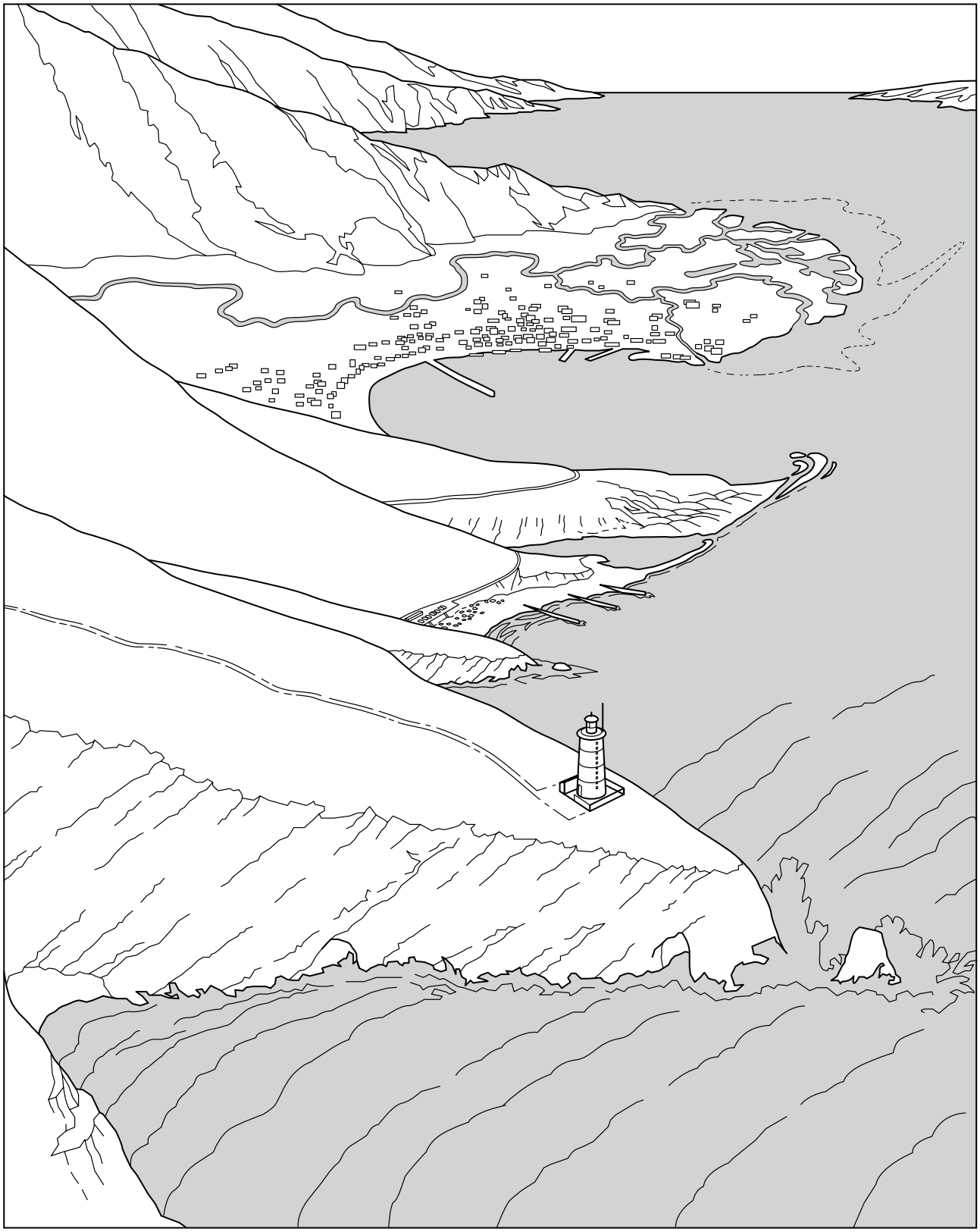
C
I

1

Name:..... Form:.....

See **pages 4 and 5** of The Coast Book
or **Poster 1:** Coastal Environments

# Coastal environments



# 1 Answers, Notes, Background

See **pages 4 and 5** of *The Coast Book*
or **Poster 1:** *Coastal Environments*

**The worksheet OPPOSITE has been left without any questions to give you the greatest flexibility.**

**Appropriate questions will suggest themselves from the annotation below.**

This is a resort beach.

This is a bay.

This is a port, but it could be any form of settlement.

This is a delta. The channels running across it are called distributaries.

You can see suspended sediment here. This is being carried from the delta by coastal currents.

This is a coastal road high above the sea. It is following the contours of the coast, and so goes in and out.

These are ocean waves.

These are groynes designed to prevent longshore drift and loss of beach sand.

This is a sand spit formed by longshore drift.

These are sand dunes backing the beach.

The vegetation on this headland is especially adapted to be tolerant of salt water spray and high winds. It is usually treeless.

This is almost a bar blocking off the river from the sea.

This is a lighthouse designed to give warning of rocks beyond the headland.

This is a cove, a small bay produced by the erosion of a weak band of rock.

This is a stack, the remains of the former location of the headland.

The waves breaking against the headland are bigger than the waves in the bay.

These cliffs provide a nesting place for a wide range of birds.

The waves bend as they enter a bay.

There is no beach on this exposed headland because the waves are too strong.

2A

Name:..... Form:.....

See **pages 6 and 7** of The Coast Book

# What makes a coast?

**Coasts are places where the sea affects the land.**

What is the flat area of sand or pebbles called?

✎ .....

What is another word for shingle?

✎ .....

What is the effect of the tide?

✎ .....

.....

.....

.....

In which part of a coast would you expect to find a beach?

✎ .....

What feature stands out to sea?

✎ .....

What would you call a large inlet in the coast where there is a river?

✎ .....

# 2A Answers, Notes, Background

See **pages 6 and 7** of The Coast Book

## Answers

1. **A beach.**
2. **Pebbles.**
3. **Tides control the range of height of the sea and so determine the part of the beach or cliff that the waves can act on.**
4. **In a bay.**
5. **A headland.**
6. **An estuary.**

## Notes

*This simple comprehension is designed to make sure that the basic words used in coastal studies are known.*

*Shingle is a regional term for beach pebbles. It is generally used for flint pebbles that are commonly found along the coast of southern England.*

*Wave action can only operate at the height of the sea. Tides are vital in allowing waves to work over a range of heights. Tides vary in their range depending on local situations. Many tides change the height of the water over a few metres, but in bays and estuaries the tidal range can be greater, for example ten metres. These differences in tidal range can affect the way the waves erode the land. The bigger the tidal range, the more opportunity for material to be scoured from the upper part of a beach during a falling tide.*

*Estuaries, rather than deltas, are the most common result of rivers reaching the sea. We have few deltas in the UK because recent Ice Ages have caused valleys to be overdeepened at the coast and then flooded. We will only see deltas when the overdeepened valleys have been filled with sediment.*

Name:..... Form:.....

Based on **pages 6 and 7** of *The Coast Book*

# Practical work: Choose a coast

1. Find a map which shows the coast in detail. An Ordnance Survey map is one good source.

2. Place a piece of tracing paper over part of the coast. You should choose a piece of map about 15cm long.

3. Copy the outline of the coast using a soft pencil.

4. Shade in the side of the tracing that is land.

5. On the side of the coast that is sea, write the words 'bay' and 'headland' at every place you can find them. Fasten the tracing to the bottom of this page.

**Fasten your tracing here.**

# 2B Answers, Notes, Background

Based on **pages 6 and 7** of *The Coast Book*

## Answers

**This will depend on individual maps chosen.**

## Notes

*This worksheet focuses on map skills. It is important that children learn that they need to draw slowly, lightly and carefully. They should fasten their tracing paper to the map using Blu-Tak or similar.*

*Help them to choose a map that has bays and headlands, and not a long stretch of featureless coast. It may be too hard for children to work with a region that has many small coves and inlets.*

*You may care to photocopy maps (in accordance with the school's photocopying licence) so you do not have to buy too many maps, to make sure all children study the same area and to help you control the map area the children draw. Unless you have a preference, North Cornwall and North Devon are good areas to draw.*

*The drawing is important. Writing on a photocopy does not develop skills in carefully reproducing an original. By drawing over a map, and saying out loud 'bay' and 'headland' every time they draw one, the children will be actively thinking about what they are drawing.*

*The best maps are large scale, at least 1:25,000. It may be appropriate to use a map of an area you will be visiting on a field trip or an area which can be the focus of study from the classroom.*

*You may want to get children to copy more than one stretch of coast, so they can begin to appreciate that coasts vary from one place to another.*

Name:..... Form:.....

Based on **pages 6 and 7** of *The Coast Book*

# Practical work: Choose a coast from a satellite image

1. You have been given a printout of a satellite image that shows part of the coast of the UK.

2. Place a piece of tracing paper over part of the coast. Choose a piece of coast about 15cm long.

3. Copy the outline of the coast using a soft pencil.

4. Shade in the side of the tracing that is land.

5. On the side of the coast that is sea, write the words 'bay', 'beach' and 'headland' at every place you can find them. Fasten the tracing to the bottom of this page.

**Fasten your tracing here.**

# Answers, Notes, Background

Based on **pages 6 and 7** of *The Coast Book*



## Answers

**This will depend on individual maps chosen.**

## Notes

*This is an opportunity to download and print out a satellite image in colour. Several of these are available for parts of the UK coast on the dedicated web site.*

*Click on:*

*www.curriculumvisions.com, then coasts, then The Coast Book, then page 6.*

*Choose your piece of coast. These images are detailed enough for beaches to be identified as yellow bands.*

*You can also develop map skills at this point if you can get an Ordnance Survey map of about the same area as the chosen satellite image. A 1:250,000 map is appropriate in most cases.*

*You can discuss with the children how the map has to represent information using lines, and how it shows beaches by means of symbols. In particular, get the children to see how much detail is represented, and how a map uses line work to make it easier for people to interpret some aspects of a coast.*

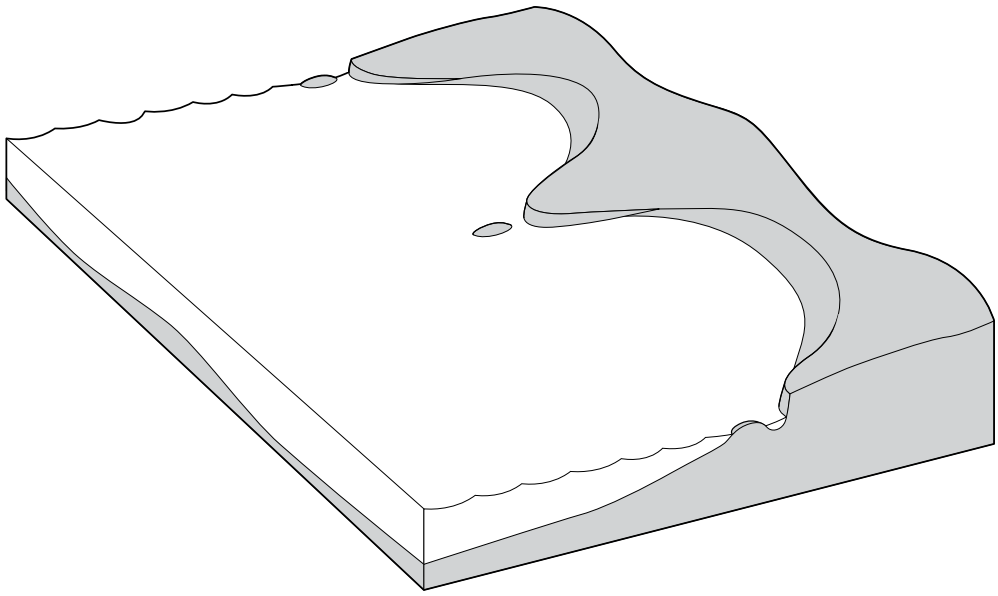
*You can discuss how a map is useful in some types of work and an image is useful in others.*

Name:..... Form:.....

See **pages 8 and 9** of *The Coast Book*

# Headlands

**Headlands are places where hard rocks are worn away more slowly than other parts of the coast.**



**Q1.** Write the word headland in each of the correct places on this diagram.

**Q2.** Write the letter S beside the part of the coast that shows where the headland used to be.

**Q3.** Are headlands sheltered or exposed parts of the coast?

✎ .....

**Q4.** Explain why headlands do not have beaches in front of them.

✎ .....

.....

.....

.....

.....

# Answers, Notes, Background

See **pages 8 and 9** of The Coast Book

## Answers

1. **Three headlands are shown, one at either end of the diagram and one in the middle.**

2. **The letter S should be placed in front of each headland (the letter stands for stack, introduced on page 14 of the student book).**

3. **Exposed.**

4. **Headlands are places of deep water. They get a tremendous battering by waves during storms. Rocks that fall from the cliffs are quickly broken down and the fine materials swept away into the more sheltered parts of the bays. This is why headlands rarely have beaches at their feet.**

## Notes

*You may care to ignore the arrows showing how waves are concentrated on headlands when discussing this topic with the less able. For the more able, the extra energy on the headlands may raise the question as to why the headlands are simply not worn down and the coastline made flat.*

*The answer to this is that as the headlands are worn back, the bays become less deep and therefore more exposed. This makes the bays more prone to erosion, and so they wear back. In this way both headlands and coasts wear back at more or less the same rate.*

*The topmost picture on page 9 clearly shows the remains of headlands as stacks (small islands) off the headlands. The white foam also indicates the strength of the waves. There is a headland in the distance.*

*The two photographs are shown to enable you to draw contrasts between rocks and headlands. The upper rock is a heat baked (metamorphic) rock. The lower picture is of a steeply dipping limestone rock.*

*Notice also that the upper picture has some round caves, while the lower picture has slit-like coves that exactly match a band of less hard rock. You may want to mention these features when you study caves on page 18 of The Coast Book.*

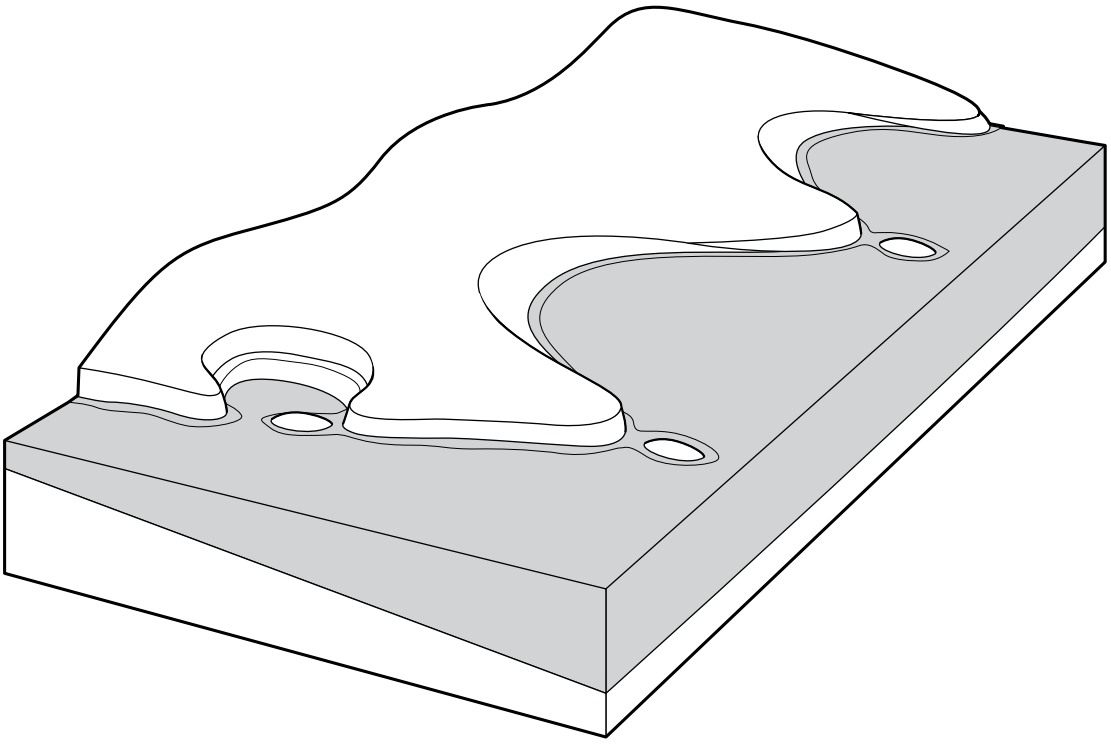
*Some children may ask why the tops of the cliffs are level. This is a difficult point to answer. The evenness of the cliff tops is because they are the remains of a former beach that has been elevated by earth movements. The fact that parts of the Earth go up and down may have been tackled in the Mountain topic. This is a demonstration of that fact.*

Name:..... Form:.....

See **pages 10 and 11** of *The Coast Book*

# Bays

**Bays are the more sheltered parts of a coast, almost always containing beaches.**



**Q1.** Write the word headland in each of the correct places on this diagram.

**Q2.** Write the letter S beside the part of the coast that shows where the headland used to be.

**Q3.** Are headlands sheltered or exposed parts of the coast?

✎ .....

**Q4.** Explain why headlands do not have beaches in front of them.

✎ .....

.....

.....

.....

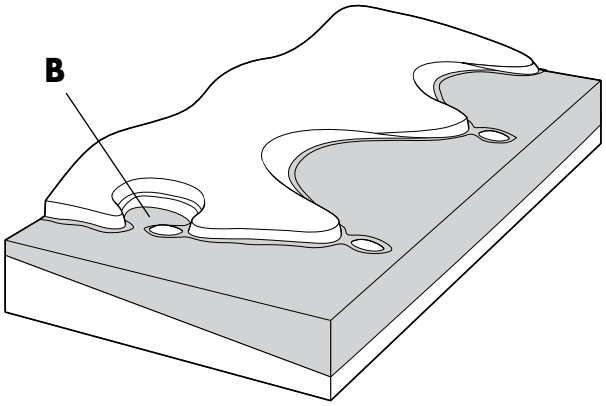
 

# Answers, Notes, Background

See **pages 10 and 11** of *The Coast Book*

## Answers

1. **See diagram below.**




2. **They partly enclose the bay and are shaped like horns (or similar description).**

3. **Soft rock (although it may not be very obvious if it is covered by vegetation).**

4. **A beach.**

## Notes

*All bays are the result of erosion of soft rocks compared to nearby headlands. However, the shape of the bay depends on the nature of the geology. In most cases bands of rocks lead directly out to sea and these produce bays with headlands standing out from the coast. Just occasionally – and famously – bands of rocks run parallel to the coast, and bays form when the hard rock by the coast is broken through. Then the soft rock inland is scooped out. The headlands then lie parallel to the coast.*

*Lulworth Cove, Dorset, is the classic example of this. It is shown on pages 10 and 11 of The Coast Book.*

*Students should notice that waves in bays break on beaches. By the time the waves have travelled over wide beaches they have less erosive power than the waves in deep water at the headland. This is one reason why sand remains in the bay and is not carried out to sea.*

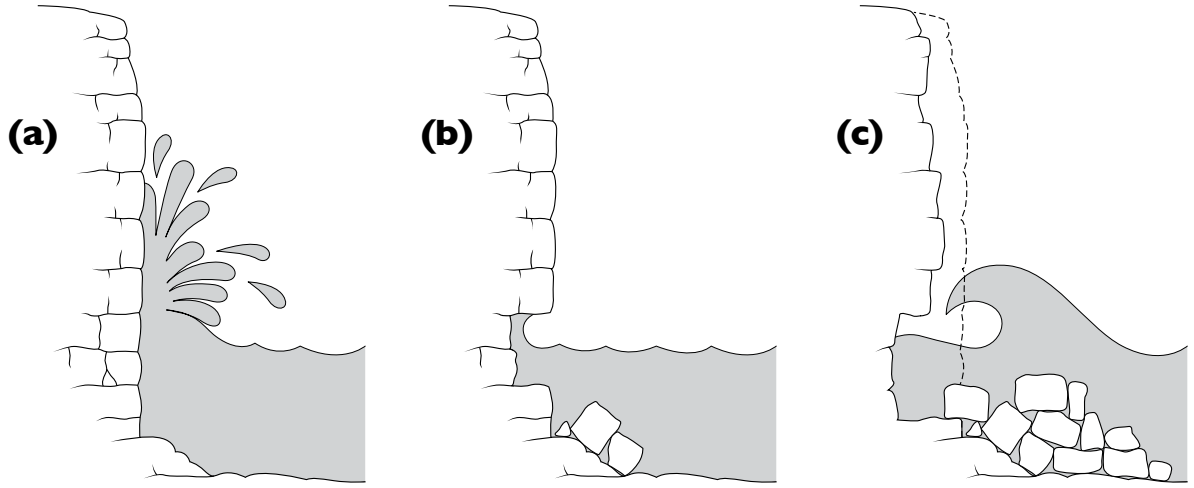
5A

Name:..... Form:.....

See **pages 12 and 13** of *The Coast Book*

# Pounding waves, crashing cliffs

**Tall cliffs tend to collapse when they have been undercut.**




**Q1.** Write a description to explain how the cliffs in the diagrams are worn back.

✎ .....

.....

.....

.....

.....

.....

**Q2.** What happens to the rocks that fall down in front of a cliff?

✎ .....

.....

**Q3.** What is the dotted line on the right hand diagram there for?

✎ .....

.....

# Answers, Notes, Background

See **pages 12 and 13** of The Coast Book

## Answers

1. **When waves break against a cliff the force of the water is like a hammer beating on the rock (a). When the wave is spent, any loosened blocks can fall out (b). Then the next wave approaches, hammering the cliff once more (c). (Note: it may take many years for waves to prise a block loose.)**

2. **They are eroded by waves before the attack on the cliff resumes.**

3. **To show where the cliff face was before the cliff collapse.**

## Notes

*This diagram gives a good opportunity to show how many natural features change suddenly and dramatically. It also explains why something that has stood apparently unchanged for a long time suddenly changes. As a result, there can be risks associated with steep cliffs, especially those which have been undercut. Students should be trained to avoid such places.*

*The amount of cliff that has collapsed gives clues as to the frequency of collapse. In places such as Lyme Regis, where the cliffs collapse each year, there is a freshly broken cliff face and cliff-foot rubble throughout the year. Areas with glacial rocks such as Scarborough are also regular sites of collapse.*

*Notice that in these diagrams deep water is always shown, implying that we are dealing with a cliff whose erosion takes place without the effect of a beach. In fact, most erosion takes place on the few occasions when the waves are whipped up by storm winds. As a result, many more cliff falls occur during stormy winters than in calm summers.*

Name:..... Form:.....

Based on **pages 12 and 13** of *The Coast Book*

# Practical work: Investigate cliff steepness

**You will need some very dry sand, a little water and a tray for this work.**

**You are going to explain why headlands look different.**

1. Make the dry sand into as steep a pile as possible. Why can't you get it to form a steep slope?

✎ .....

.....

.....

.....

.....

2. Make the sand damp (not wet) and start again. Can you now make a headland with a vertical cliff? Explain what the water is doing.

✎ .....

.....

3. Very carefully pull away the sand from the base of the 'cliff'. You are imitating the action of waves. What happens eventually?

✎ .....

.....

.....

# Answers, Notes, Background

Based on **pages 12 and 13** of *The Coast Book*

## Answers

1. **Because weak materials like sand always collapse to the same angle of rest. Cliffs with soft rocks will often have a low angle of rest.**

2. **The water acts like a cement, holding the sand together.**

3. **At first children will find they can undercut the cliff, but eventually the face will collapse.**

## Notes

*The objective is to ensure that children begin to see the real world in terms of models. They can choose between soft rock (dry sand) that collapses or rock that is cemented together (in this case by water).*

*You could extend the practical to investigate how cliffs of different heights behave, and whether a low cliff can be undercut more than a tall one. You could also demonstrate that the material that collapses in front of a tall cliff has a greater volume than the amount that collapses in front of a low cliff. It would take similar waves longer to remove the large quantity of debris that falls, and so tall cliffs should retreat more slowly than low ones.*

Name:..... Form:.....

Based on **pages 12 and 13** of *The Coast Book*

# Practical work: Investigate the way water works on a cliff

**You will need a bucket, some stones, water and an old plastic chair for this work. You should do this in the school playground or somewhere else where water can be splashed without causing damage.**

**The ability of a wave to cause damage to a cliff depends on two things: the amount of water and the speed it is moving. You are going to find out about the power of this moving water.**

1. Fill a bucket with water and pour it over the chair. Although the chair will get wet, the water will not cause much change because the water does not have much speed.

2. Fill the bucket again and then throw the water against the side of the chair. (This is a model of a wave hitting a cliff.) What happens?

✎ .....

.....

3. Put some stones into the bucket and fill it with water again. Now throw the contents of the bucket against the side of the chair. (This is a model of a wave carrying pebbles hitting a cliff). What did you notice?

✎ .....

.....

.....

.....

.....

.....

.....

# Answers, Notes, Background

Based on **pages 12 and 13** of *The Coast Book*



## Answers

2. **The chair will be knocked over.**

3. **The stones and water will knock over the chair, and then the stones will continue travelling on their own.**

## Notes

*The objective is to show that the energy of moving water is high. The water has a large weight (mass) of its own, but when simply poured out slowly, it has little energy. (Energy in movement is proportional to mass multiplied by the square of the velocity.)*

*When the bucket of water is thrown at the side of the chair, the chair will be knocked over. This is very messy, so arrange for it to be done in a large, empty space. But the effect is dramatic and explains all manner of things related to moving water. Children could be asked to imagine themselves in the path of moving water of this kind. They would be bowled over if the water was high, and knocked off their feet if the water was low.*

*From this children can readily understand the power of moving water.*

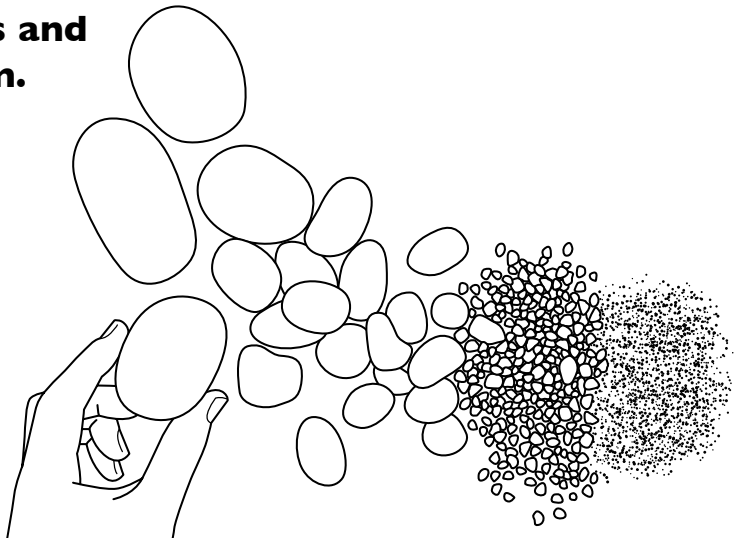
*The purpose of adding stones is to show that the stones have a momentum of their own and can easily be carried by water. When the bucket of stones and water is thrown, the stones will travel with the water. This is a common experience of stones being thrown against the cliff, causing abrasion. Children can also see that because so much of the weight of the stones is taken up by the water (this can be linked to the buoyancy effect in the study of Forces in the science curriculum), even large stones and boulders can be carried by waves.*

Name:..... Form:.....

See **pages 14 and 15** of *The Coast Book*

# Wearing cliffs away

**Cliffs can be worn away when waves containing stones and sand break against them.**



**Q1.** On this diagram write the words pebbles, gravel and sand against the correct material.

**Q2.** What happens to the pebbles as they are thrown about by the waves?

✎ .....

.....

.....

.....

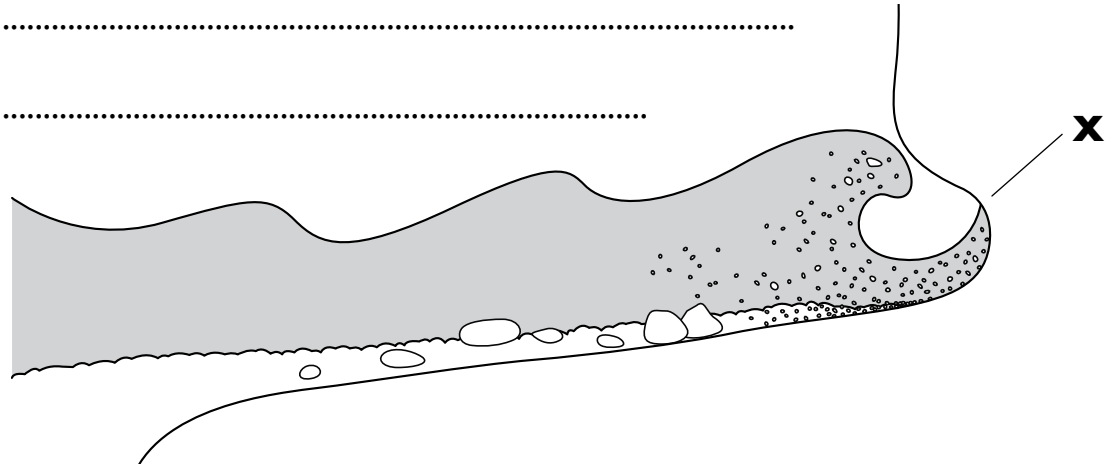
**Q3.** Name the feature shown at X below and explain how it is produced.

✎ .....

.....

.....

.....

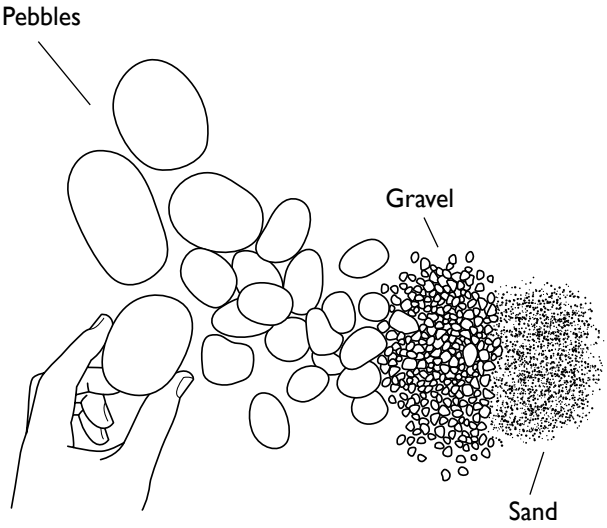


# Answers, Notes, Background

See **pages 14 and 15** of The Coast Book

## Answers




2. **They are made more rounded and broken up into smaller material, such as gravel and sand. (This is a process called attrition.)**

3. **Wave-cut notch. It is produced by the wearing away of the cliff by pebbles and sand carried by the waves.**

## Notes

*It is very important to distinguish the two different processes at work in eroding a cliff. One process – described on the previous spread – is the result of the direct action of water on the cliffs. This prises out blocks and the blocks fall to the cliff foot.*

*Once the material has been dislodged, waves then break these blocks down further into smaller pieces that can easily be moved. This produces pebbles, gravel and sand.*

*These rock fragments can be carried in the water as a kind of natural 'shot'. They abrade the cliff when waves crash against it.*

*In many situations, the processes of loosening blocks and abrading the cliff take place along separate parts of a coast. The jagged nature of many headlands at high water shows the dominant process to be direct water action. By contrast, many cliffs behind beaches are smoothed, showing that the beach material has been frequently thrown against them.*

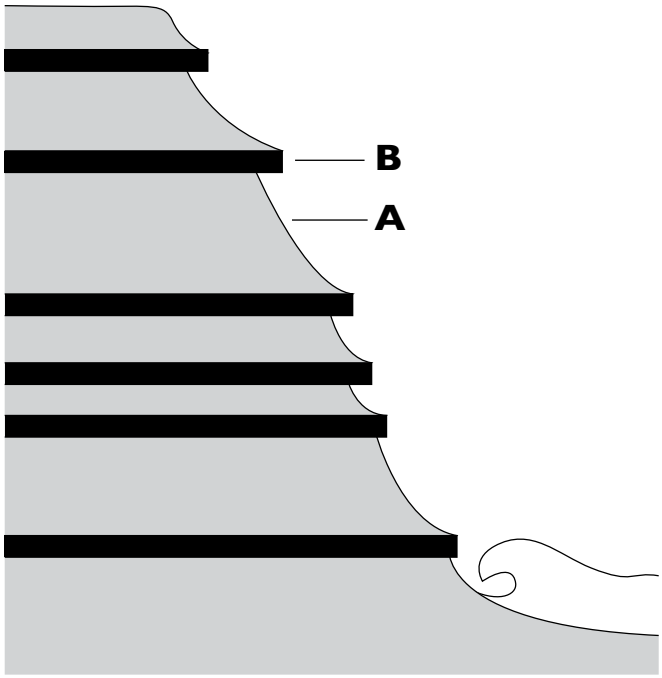
7A

Name:..... Form:.....

See **pages 16 and 17** of *The Coast Book*

# Why cliffs are different shapes

**Q1.** In this diagram there are some thin, dark ledges of rock. Are they harder or softer than the other rock?




✎ .....

**Q2.** As the soft rock at A gradually wears away, what happens to the ledge at B?

✎ .....

.....

.....

.....

**Q3.** When rock falls from the cliff, where will it go and what will happen to it?

✎ .....

.....

.....

.....

.....

.....

.....

.....

.....

.....

# Answers, Notes, Background

See **pages 16 and 17** of The Coast Book

## Answers

1. **They are harder.**

2. **It will collapse under its own weight and under the weight of the layer above it.**

3. **When material falls from a cliff it will fall to the bottom of the cliff and make a jumble of rock. At first this rock will have sharp edges, but as the waves attack it, these edges will be rounded off until the rock becomes boulders. In time the boulders will be worn completely away.**

## Notes

*There are many differences in cliff shape, and they almost all relate to differences in rock hardness.*

*If rocks are made of large blocks, they behave like tall walls. Little will happen until the bottom of the cliff is undercut and then the whole slab of cliff will collapse. This is shown on Picture 1, page 16 of The Coast Book. If the material is very soft, the main influences on the cliff will include the wetness of the material. Saturated material has very little strength. Many soft cliffs fill with water in winter and then collapse.*

*The most interesting cliffs are those that have alternating bands of soft and hard rock. Here the soft materials tend to fall away, often due to the effects of strong winds. Frost shatters the rock higher up the cliffs while wave action erodes from below. The whole cliff is prevented from collapsing by the ledges of hard rock. These often have considerable strength and so can stand out from a cliff, which is what makes such cliffs look like natural staircases.*

Name:..... Form:.....

Based on **pages 16 and 17** of *The Coast Book*

# Practical work: Investigate the way ledges of hard rock affect cliff shapes

**You will need some sheets of cardboard, each side about 15cm and some dry sand for this practical.**

**You are going to try to make a cliff using weak material (dry sand) and strong material (sheets of cardboard).**

1. Spread out some sand in a tray to make a layer about 2cm thick. The layer should be about the same size as the sheets of cardboard you have.

2. Level the top and place a sheet of cardboard on it. Now put a thinner layer of sand on the cardboard and then place a sheet of cardboard on top.

3. Continue to build up layers, much like you would make a layer cake. Now, try to change the shape of the cliff by pushing the cardboard layers in and out.

# Notes

*The shape of a cliff is determined by both the hard and the soft rock. The hard layers act like the sheets of cardboard, supporting the material above. The soft layers always collapse down to a more gentle angle. As a result, they undermine the hard layers, which eventually break. As soon as they do this, all of the material above collapses as well.*

*By experimenting with the position of the sheets of cardboard, children can bring out this important conclusion. Notice that in a cliff, the lowest layer is undermined by wave action.*

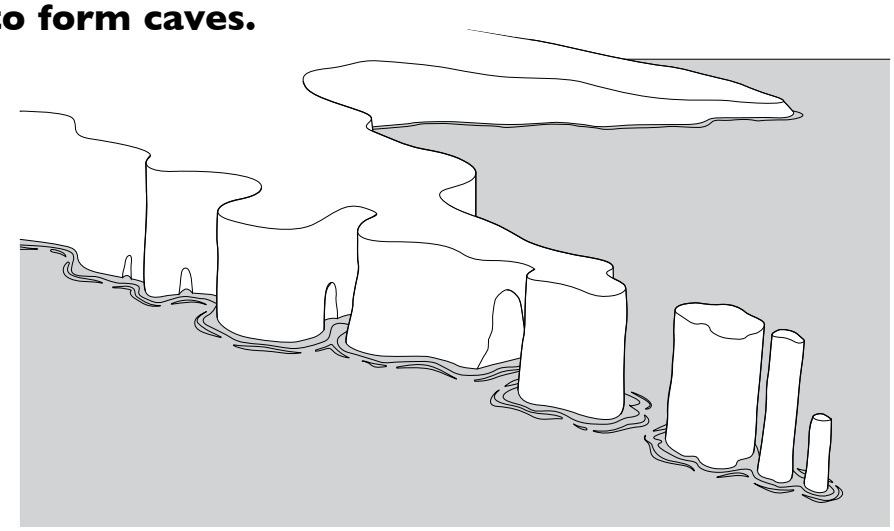
8

Name:..... Form:.....

See **pages 18 and 19** of *The Coast Book*

# Caves, arches and stacks

**As cliffs are attacked by waves, places where rocks are weakest are opened up by the waves to form caves.**



**Q1.** Label these features on the diagram above: cave, arch, stack, needle, stump.

**Q2.** Why does an arch change to a stack?

✎ .....

.....

**Q3.** Stacks and arches all form part of a coastal feature. What is it?

✎ .....

**Q4.** Not all caves are the same shape. Why not?

✎ .....

.....

.....

.....

.....

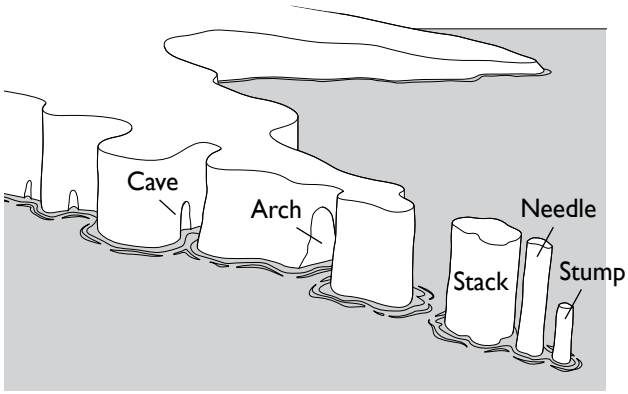
.....

# Answers, Notes, Background

See **pages 18 and 19** of The Coast Book

## Answers

1. **As diagram below.**




2. **Because the top of the arch collapses.**

3. **A headland.**

4. **The shape depends on the rocks that have been eroded. Many caves are eroded in bands of weaker rock, so the shape of the cave will reflect the shape of the weak rock band.**

## Notes

*There are a number of caves shown on the diagram, so various locations for 'Cave' are possible.*

*It is common to think of caves as round and tunnel-like, whereas they are rarely round, and are usually conical, getting smaller further inside.*

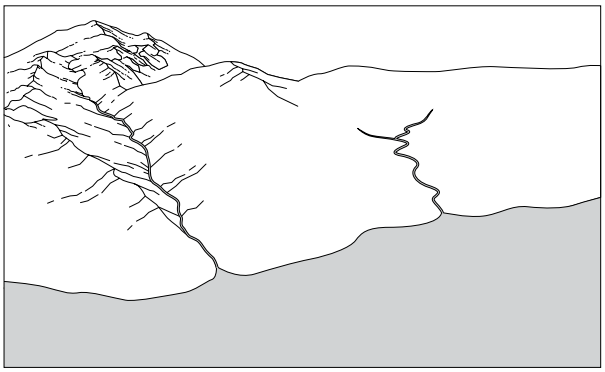
*The shape of the cave reflects the nature of the rock. Asking children to look carefully at page 18 of The Coast Book should help to clarify this point. All of the caves in this picture lean to the right, the same as the weak band of rock in which they are formed.*

Name:..... Form:.....

See **pages 20 and 21** of *The Coast Book*

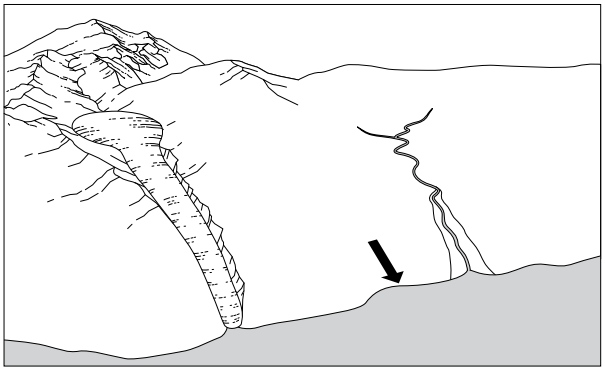
# Estuaries, lochs and fjords

**During an Ice Age, the coast can be changed rapidly and new arms of the sea formed.**



**Q1.** An arm of the sea is a long, narrow inlet. What is the name of this kind of inlet in mountainous regions?

✎ .....



**Q2.** What causes an inlet to change shape?

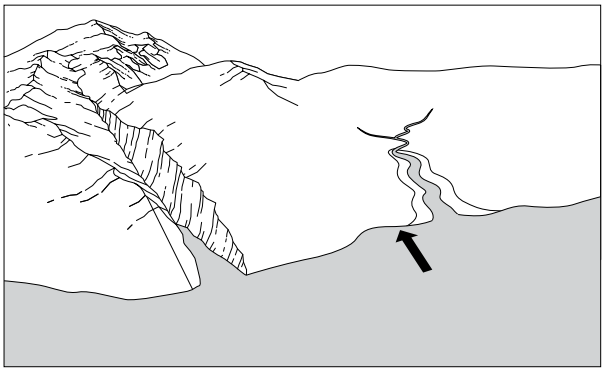
✎ .....

.....

.....

.....

.....



**Q3.** Use the diagram on the right to explain how a glacier could make a sea loch or fjord.

✎ .....

.....

.....

.....

.....

.....

.....

# Answers, Notes, Background

See **pages 20 and 21** of *The Coast Book*

## Answers

1. **A sea loch or fjord.**

2. **A glacier flowed down a former river valley, gouging it deeper and wider.**

3. **The sea level fell and ice filled the river valley. The glacier cut down to the new, lower sea level. At the end of the Ice Age the ice melted and sea levels rose, flooding the lower part of the glacial valley.**

## Notes

*This is probably one of the most difficult areas of coastal study because it involves an appreciation of past changes of climate and the fact that the land could have been ice-bound just a few tens of thousands of years ago. Furthermore, the causes of estuaries are different to the causes of lochs and fjords, even though they are both arms of the sea.*

*Estuaries were formed in areas just beyond the ice sheets, where rivers could still flow and, because of the lack of vegetation and the extra water available as snowmelt each spring, they were probably much more effective at eroding. As a result, a large amount of change was possible in a relatively short time.*

*Geographers use the word estuary to describe an arm of the sea in a lowland landscape. In landscapes of moderate relief, such as southwestern England, arms of the sea are known as rias, although most lay people still refer to them as estuaries.*

*Sea lochs and fjords are the result of glacial erosion and are glacial channels, not river valleys.*

Name:..... Form:.....

See **pages 22 and 23** of *The Coast Book*

# Waves on the beach

**Waves break when they reach the beach, sending water streaming up the beach.**

**Q1.** What is the cause of waves?

✎ .....

**Q2.** What is the name of a wave that curves over and breaks?

✎ .....

**Q3.** When a wave breaks and produces foamy water on the beach, what is the foamy water called?

✎ .....

**Q4.** The surf first rushes up the beach, then stops. What happens next?

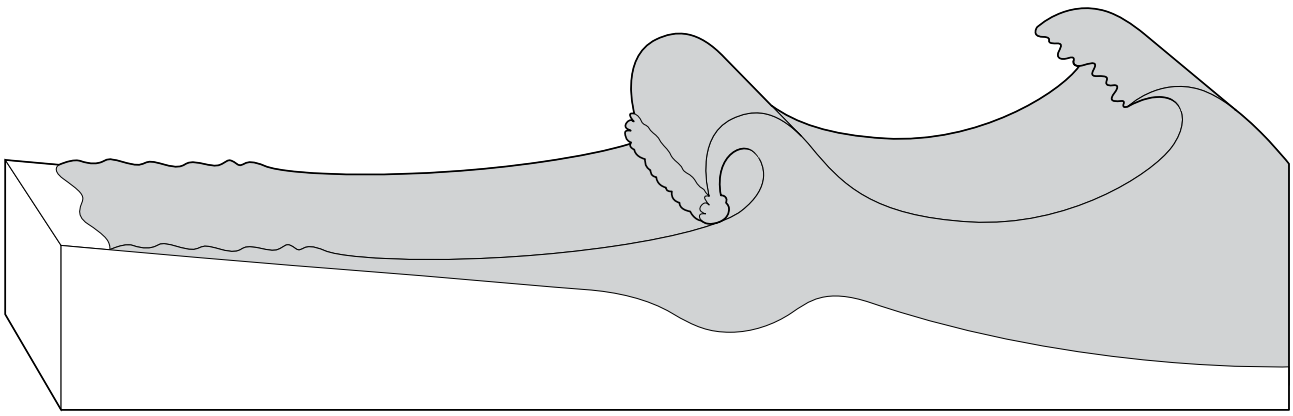
✎ .....

.....

.....

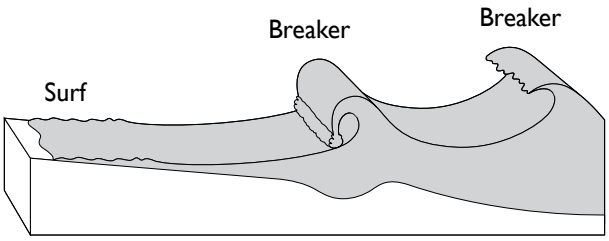
.....

**Q5.** Write the words 'breaker' and 'surf' on the diagram below in their correct places. You may use a word more than once.



# Answers

1. **The wind.**
2. **Breaker.**
3. **Surf.**
4. **Some sinks into the sand while the rest begins to flow back down the beach (as backwash).**
5. 


# Notes

*Waves are the most important part of coastal studies and they need to be looked at in detail. Waves on a beach can be studied safely in times of calm weather and can form a significant part of any field study.*

*Most children think a wave is a wave is a wave. The purpose of this page is to begin to unravel this idea and help them to see that a wave is made of parts that do different things. On the next page we will take this idea further and look at wave shapes.*

*When waves break on a beach they first rear up, then break. Waves break because, as the water becomes shallower, near land, the lower part of the moving wave begins to 'feel bottom' and is slowed down by friction, while the top part continues to move at the same speed as it did in open water. The result is that the top part of the wave gains on the bottom part and then crashes forward.*

*A wave contains an unbroken crest. As soon as the wave begins to break, it becomes a breaker. The crest is white because it is a mixture of air bubbles and water. The air bubbles keep the water from having the same transparency as still water. You can demonstrate this with any fast-moving water, such as a tap turned on full, which produces white water that clears as the air bubbles escape in a bowl.*

*The whole broken-water area is called the surf. For the more able you may wish to get them to remember that the part of the surf running up the beach is the swash, and that running back down the beach is the backwash. See the next page for how to get the class involved in making wave voices.*

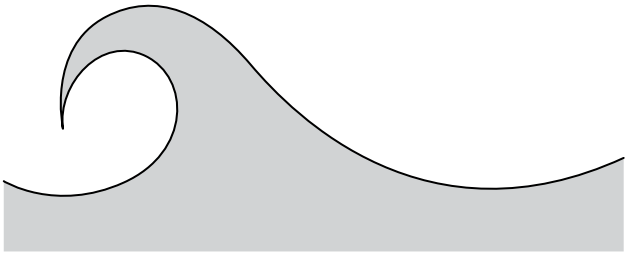
*On a field trip it is good to find a safe place and then let children stand in the surf zone so that their feet and ankles can experience the movement of water, and they can look down into the water and see the sand moving.*

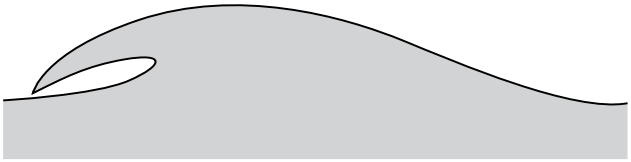
Name:..... Form:.....

See **pages 22 and 23** of *The Coast Book*

# Waves on the beach

**Waves come onshore differently during storms than in fair weather.**





**Q1.** During a storm, waves grow taller and crash more fiercely down onto a beach. Use this information to write 'storm wave' against one of the diagrams above. Write 'fine weather wave' against the other.

**Q2.** When a wave breaks, what happens to the sand on the beach?

✎ .....

.....

.....

.....

**Q3.** The sand is pushed up the beach by the breaking wave. What happens to it next?

✎ .....

.....

**Q4.** Which shape of wave do you think moves most sand on the beach as it breaks?

✎ .....

.....

.....

.....

.....

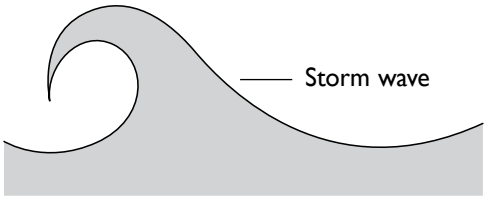
 

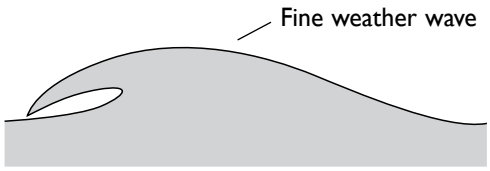
# Answers, Notes, Background

See **pages 22 and 23** of *The Coast Book*

## Answers

1.




2. **The sand is dug out of the beach (caption to picture 2) and suspended in the water for a while. During this time it is carried by the wave.**

3. **Some of the sand is pulled back down the beach by the backwash (until the next breaking wave checks its path).**

4. **The fine weather wave, because its breaker is angled forwards, whereas the breaker of a storm wave reaches almost directly down on to the beach and moves back as much as it moves forwards.**

## Notes

*To take the idea of waves further, the children need to feel the rhythm of the waves. For this you can get a class to make wave "voices" which you can tape record and play back to them. See how realistic they can be.*

*You can make wave voices quite easily. You simply say swaaaaaaaaash on one continuous outward breath, then pause and say backwaaaaaaaaaaash as you take air back in. If the class does this rhythmically, they can imitate a wave breaking on a shingle beach quite well. They can also run backwards and forwards across the classroom as they do it.*

*To take this further, explain that the waves come faster in times of storm than in fair weather. There are about 11 waves a minute in stormy weather and only 7 in fine weather (of course this varies and these numbers are just a rule of thumb). Children can try to time their swashes and backwashes to match this.*

*When more waves pile up together in time and space, they become shorter and taller because the same amount of water must get into a smaller horizontal space. This changes the shape of the wave. Waves then curl right over and crash, or plunge onto the beach, digging in and carrying more sand back than forward.*

*When there are fewer waves on the beach, the waves tend to be flatter and spill forward over themselves. Now they do not dig into the beach as much and when they break they tend to push sand ahead of themselves. In this way storm waves tend to take sand off of a beach very quickly and fair weather waves tend to push sand back up on to a beach over a longer period of time. If any child spots them this, coupled with the tide, is the origin of the troughs and ridges (called berms) on a beach.*

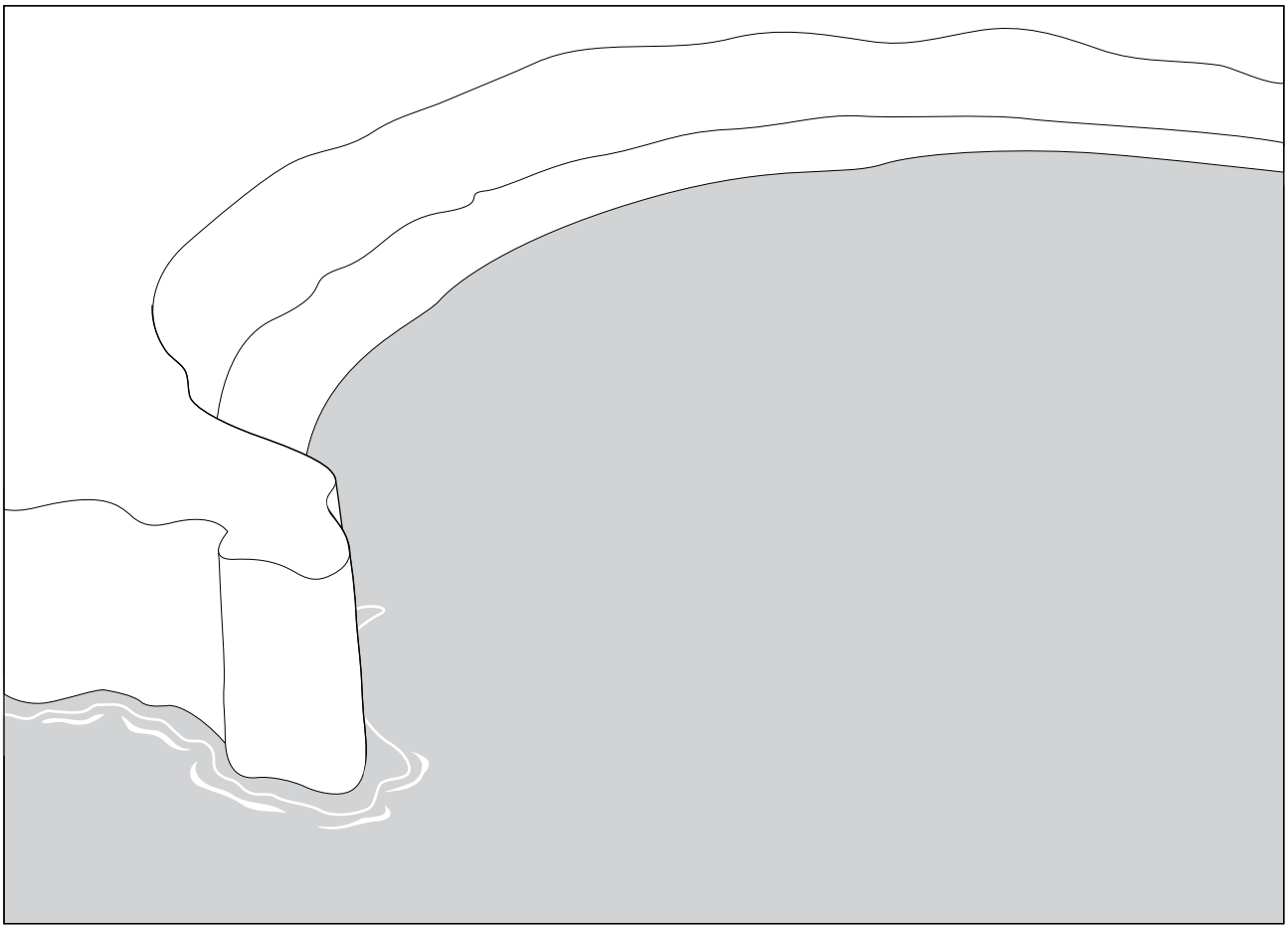
Name:..... Form:.....

See **pages 24 and 25** of *The Coast Book*

# Sand and shingle beaches

**In a bay you can sometimes find that the waves have sorted out the sand from the pebbles.**

**Q1.** The wind blows from the left to the right on the diagram below. Label the place that you think is most sheltered and also the place you think is most exposed.



**Q2.** The most exposed places have the fiercest waves. When waves are very fierce, which material is most likely to remain on a beach – pebbles, mud or sand? Write the name you choose on the diagram in the correct place.

**Q3.** Sand and pebbles make beaches with different slopes. Which makes the gentler slope?

✎ .....

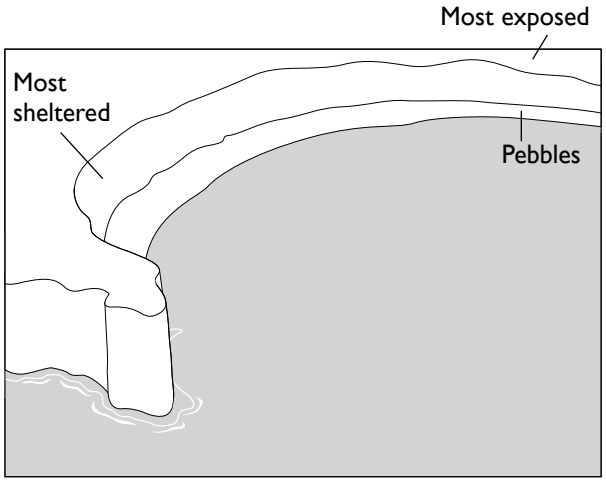
 

# Answers, Notes, Background

See **pages 24 and 25** of *The Coast Book*

## Answers

1. **See diagram.**




2. **Pebbles (and see diagram above). Any material smaller in size is likely to have been washed out to sea.**

3. **Sand.**

## Notes

*Beaches vary widely in their steepness, and in the type of materials found on them. So we often have to answer the question: why is this beach sandy, or, why is it pebbly? In some cases, the question is why is it a mixture of the two?*

*In general it is wise to steer children away from this complex topic in depth, but in case you get put under pressure, here is a summary answer:*

*The answer depends on location. Along the east England coast, in particular, the cliffs are often made from materials left after the Ice Age. This has traditionally been known as boulder clay. Here, the cliffs contain a wide variety of materials, from boulders and pebbles through sand to clay. The clay is washed away immediately, but the sand and pebbles remain to give a mixed beach. Usually the upper beach contains more pebbles than the lower beach.*

*In the south, there are many shingle beaches. The shingle is another feature of the effects of the Ice Age. The shingle is mainly flints excavated from the nearby chalk. The most famous of these beaches is Chesil beach, with pea-sized shingle at the western end and cobbles at the most exposed eastern end.*

*Most other beaches away from places with boulder clay cliffs have sandy beaches, but the sand becomes coarser and may grade into pebbles in the most exposed locations.*

*It is best to concentrate on the fact that the existence of the beach and its steepness depends on the size of the material that it is formed from. Thus shingle beaches are always steep, and sandy beaches always gentle. You may find that there are places with steep, upper, pebble beaches and gentle, lower sandy beaches.*

*In the most sheltered places of all, it is possible for mud to settle out. This is most common close to an estuary where the supply of mud is great.*

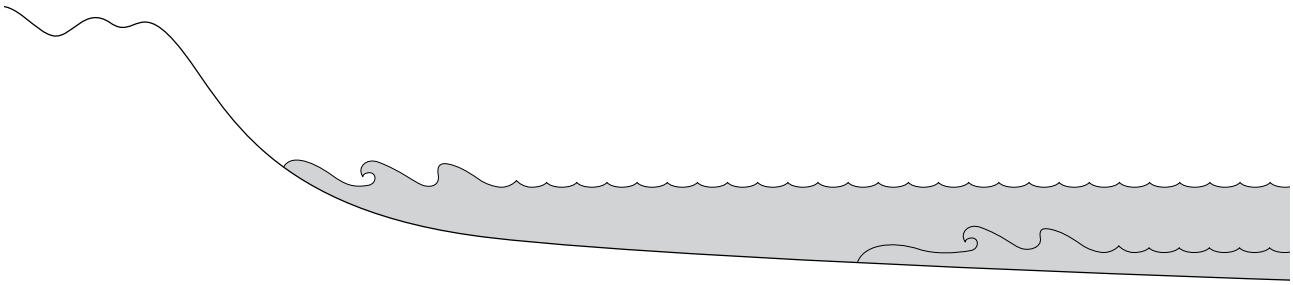
C 12

**Name:**..... **Form:**.....

See **pages 26 and 27** of *The Coast Book*

# Beaches of many uses

**Beaches are used by people on holiday. But few probably realise that where they go on a beach is controlled by how the beach forms.**



**Q1.** On the diagram above, label the upper beach, sand dunes and lower beach.

**Q2.** Now label the place where the waves reach at high tide and where they reach at low tide.

**Q3.** Label the place on the diagram where you would see people sitting down (use Picture 1, page 26 of *The Coast Book*).

**Q4.** Write down why you think they have chosen this part of the beach to sit on.

✎ .....

.....

**Q5.** In the distance of Picture 1, page 26, there are few people sitting on the beach. Write down why you think this is.

✎ .....

.....

**Q6.** Write down why you think there are few people on the right of the picture.

✎ .....

.....

.....

.....

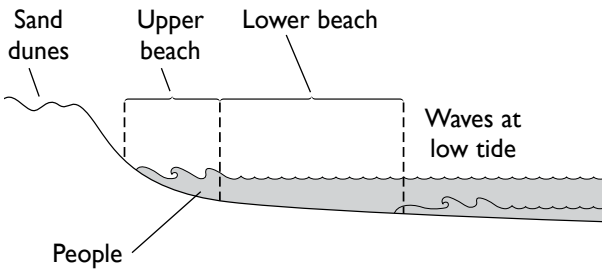
 

# Answers, Notes, Background

See **pages 26 and 27** of *The Coast Book*

## Answers

1,2,3. **As diagram.**




4. **They have chosen the upper part of the beach to sit on because it is drier, it is unaffected by tides for the longest and it is most sheltered from coastal winds.**

5. **There are fewer people in the distance because it is further from the access to the beach.**

6. **The right of the picture is the lower beach. This is exposed for the shortest period between tides, it is lower and flatter and so drains least well. The sand here is generally cold and damp.**

## Notes

*Here we change from a purely physical study and begin to look at the way that people interact with the coastal environment. Here, the children put themselves in the position of the people on the beach and then try to establish just how far people are subconsciously influenced by physical factors around them.*

*Beaches are used in many ways, and this exercise concentrates simply where holidaymakers choose to sit or play when they go down to the beach.*

*The study relates the water table in the sand and the height of the beach above low tide to the density of use of the beach.*

*There is only a small difference in height between the upper and lower beach, but this is enough to give great contrasts in use. The lower beach simply never has the time to dry out and always feels cold and damp. The upper beach may be above the reach of normal high tide and only covered by storm waves. This is indicated by the inflatable castle, which is a commercial operation and would take time to inflate and remove.*

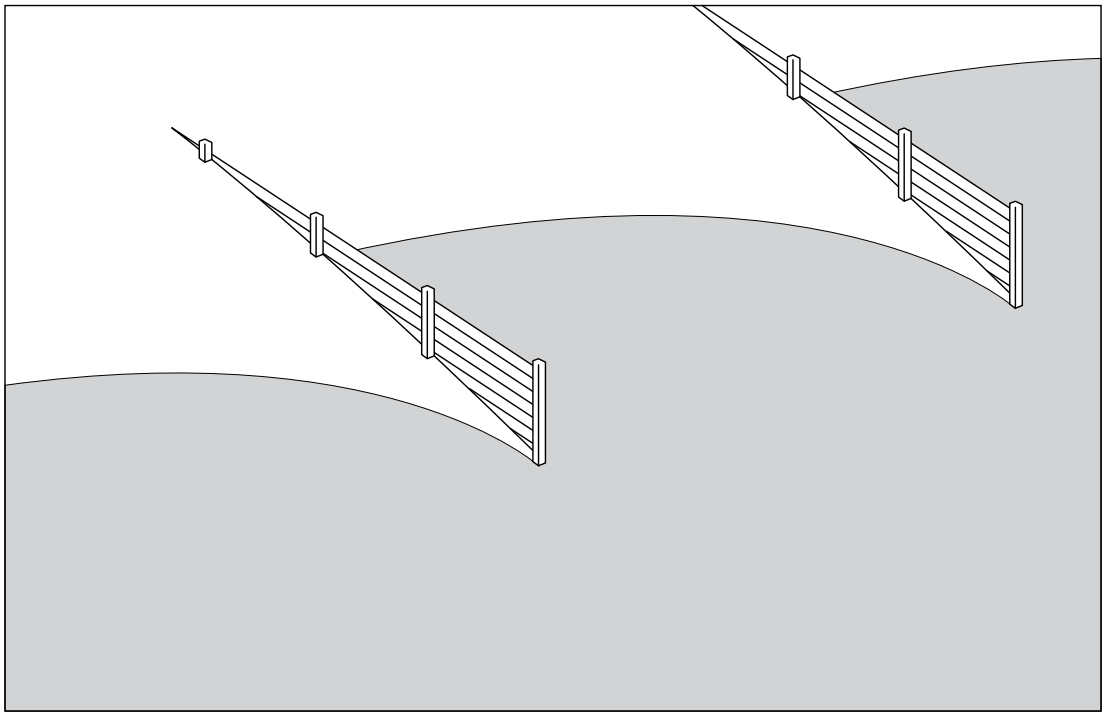
*The main access to the beach is immediately on the left of the picture. Ease of access is therefore an important factor in choosing a place to sit (in the distance there are fewer people because the effort of walking to those places is greater).*

Name:..... Form:.....

See **pages 28 and 29** of *The Coast Book*

# Moving sand

**Waves move sand along the beach, not simply up and down it.**



**Q1.** What is the name for the beach fences like those shown in this diagram?

✎ .....

**Q2.** What tells you that sand is being moved along the beach?

✎ .....

.....

**Q3.** On the diagram above, mark with an arrow, the direction that sand has been moved.

**Q4.** What is the name for the natural transport of sand along a beach?

✎ .....

**Q5.** Name one natural feature that is produced by longshore drift and that often nearly blocks an estuary.

✎ .....

# Answers, Notes, Background

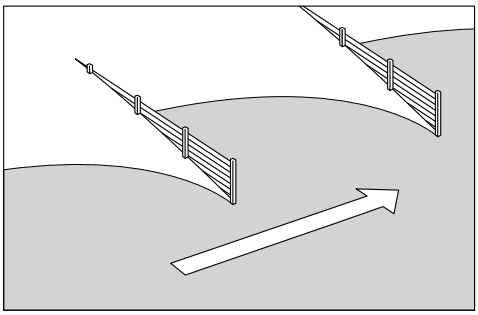
See **pages 28 and 29** of The Coast Book

## Answers

1. **Groynes.**

2. **The fact that sand has piled up on one side of the groyne.**

3. **As diagram below.**



4. **Longshore drift.**

5. **A sand spit.**

## Notes

*Longshore drift is an important process along the coast and explains how beach sand moves, why many holiday beaches have groynes, and how sandbanks build up to stop navigation. However, it is a complicated theme to deal with because the movements are small and because longshore drift is a combination of wave action and currents. Use Picture 3, page 29 to show that, if seen from above, the sea just offshore is filled with sand, making it a yellow colour. This shows that sand really is on the move.*

*When waves break, they plunge down and this causes sand to be put temporarily into suspension. This happens at the very edge of the surf zone. Currents travelling along the beach then carry this material. That is the origin of the sand seen in the picture. Currents are not discussed in the student book as the topic is too complex.*

*At the same time, waves do break at an angle to the coast and they also carry material up the beach at an angle. You can see this when you paddle in the sea, if you are on a stretch of coast where the waves break at an angle (but you will not see it in a sheltered bay where the waves break directly onshore). On a field trip it is a good idea to look for a wide beach. Steep beaches show it much better than shallow beaches, so choose one of these if you can.*

*The fact that the material moves is very important. Waves carry sand from headlands and along beaches to places where the sand builds up (such as sand banks offshore). This process uses up a large amount of wave energy. If a section of headland is protected from erosion, the sea will have no sand to carry to the nearby beaches. But the waves breaking on the beaches will still move sand along them. Quite quickly there will be a visible sign of beach loss. The beach will lower and the rock below it may even be exposed.*

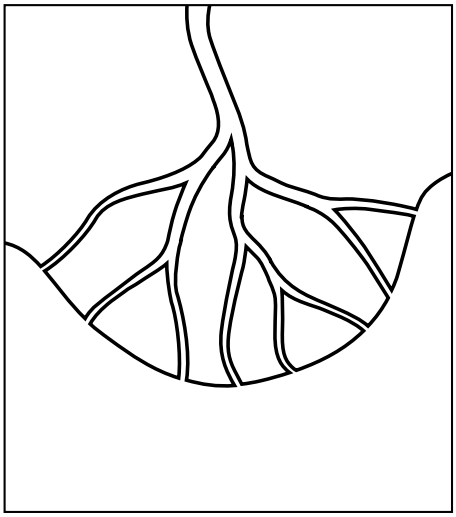
*Groynes are usually installed further along a beach from where sand is protected by a sea wall. Sea walls always cause problems further along the coast. This provides an opportunity to discuss how the coast works as a whole, and how changing one part of it (especially the part that is eroding) will cause massive (and expensive) problems elsewhere. Thus the presence of beach groynes indicates that some mistake has been made by people managing the coast. You can return to this theme later on.*

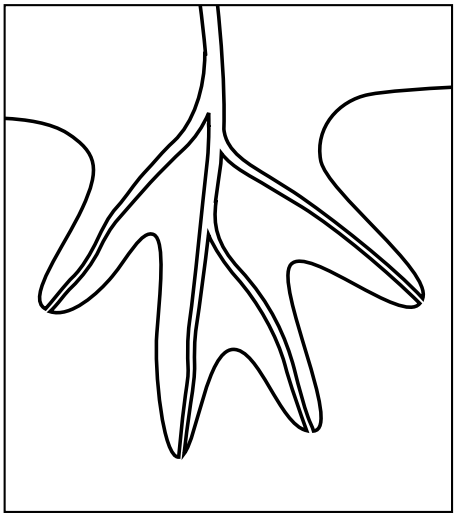
Name:..... Form:.....

See **pages 30 and 31** of *The Coast Book*

# Deltas

**Deltas are places where rivers bring large amounts of sand and mud to the sea.**





✎ .....

✎ .....

**Q1.** There are two types of delta: a bird's foot delta and a fan-shaped delta. Write bird's foot and fan below the correct diagram above.

**Q2.** Some rivers bring enormous amounts of sand and mud to the sea, but deltas do not grow very quickly. What happens to the rest of the material?

✎ .....

.....

**Q3.** On the diagram on the right, label the places where you see a delta (There is more than one!)

**Q4.** What is the shaded area on the diagram? (Refer to Picture 4, page 31 of *The Coast Book*.)

✎ .....

.....

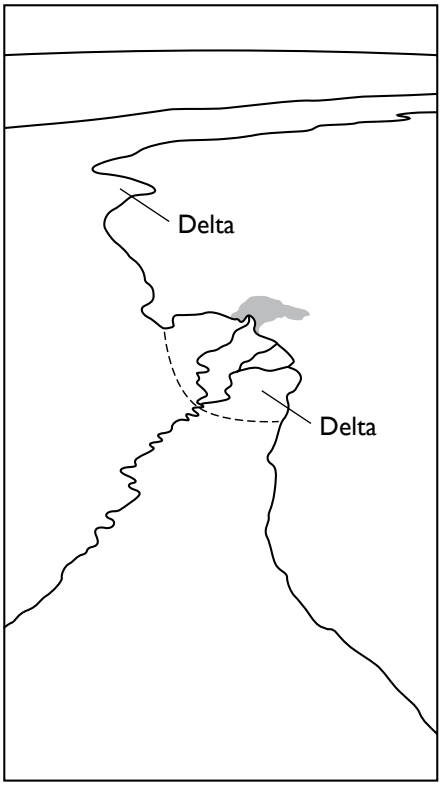
.....

# Answers

1. **Fan on left, bird's foot on right.**

2. **The currents and waves of the sea wash it away (page 31 top right paragraph).**

3. 


4. **A plume of sand carried out to sea by the force of the river water and being dispersed by the waves and currents. The currents are predominantly to the right.**

# Notes

*Deltas, like headlands and cliffs, are major sources of sand for beaches. In this case, the material brought to the coast is a mixture of mud, silt and sand (to save confusion, it is best not to use the word 'silt' to mean all such material). Waves will separate this material out quickly, and waves and coastal currents will carry the finest material out to sea. It will never be found on open beaches, but only in estuaries and marshlands. What people often refer to as mud (clay) on a beach is actually fine sand. Sand is the finest material that can remain on a beach.*

*Many rivers do not have deltas in front of them. In many cases, this is a testament to the fact that coastal drift can remove all of the material brought down by a river. Those rivers that do have deltas also carry unusually high sediment loads and are located where coastal currents are not very strong. Rivers like the Mississippi carry all the sediment for large sections of continents. In the UK, deltas are also rare because the recent Ice Age has overdeepened most valleys where they enter the sea and so a large amount of the sediment coming down the river simply settles in the deep water of the estuary, filling this in. Deltas will only stand some chance of forming when this phase is over. (If you look at the web site for the Thames estuary given in relation to pages 4 and 5, you will see, from a satellite view, the great sandbanks building up in this estuary. They show up in this high altitude view, although they do not break the surface.)*

*The shape of the delta depends on the way in which the river breaks up into small channels called distributaries. In some cases there are many distributaries, all much the same size. As a result, the delta builds out evenly, as is the case for the Niger in Africa and for the Nile. In other cases there is a dominant distributary which develops like a finger, until the channel changes direction (usually during a flood) and flows elsewhere. The Mississippi is like this.*

Name:..... Form:.....

See **pages 32 and 33** of *The Coast Book*

# Living on crumbling cliffs

**Some cliffs are hazardous to live by.**

**Q1.** Which sort of cliff will wear away fastest, a tall cliff or a low one?

✎ .....

**Q2.** Which kind of rock will be worn away fastest, hard or soft?

✎ .....

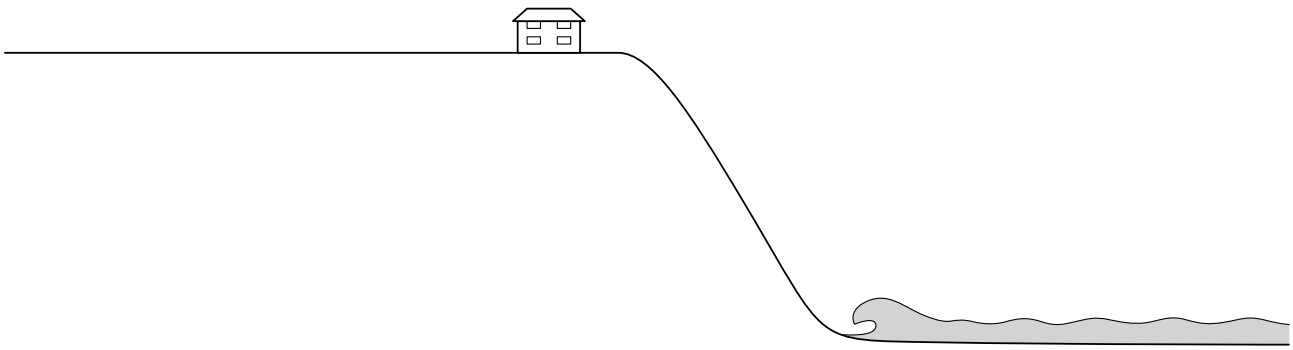
**Q3.** From your answers to Q1 and Q2, what kind of cliffs around the British coast will wear away fastest?

✎ .....

.....

.....

**Q4.** The diagram below shows a house that has been built on a cliff. Make use of Picture 2, page 33 in *The Coast Book* and complete the drawing to show where the house should safely have been built.



# Answers, Notes, Background

See **pages 32 and 33** of *The Coast Book*

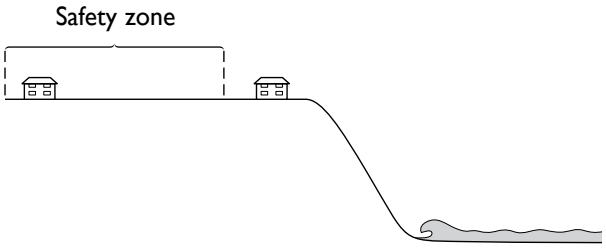
## Answers

1. **Low because there is less volume of material to be removed.**

2. **Soft.**

3. **Low, soft ones (like those along the coast of East Anglia and Lincolnshire).**

4. **Picture 2, page 33 shows that being close to the coast is unsafe. There should be an undeveloped area close to unstable cliffs. Picture 3, page 33 shows such a 'buffer' zone.**




## Notes

*In this section, we turn to the way that people develop the coast and some of the problems this might cause.*

*To begin with, we look at rapidly retreating coasts. Children could be pointed to the signs of instability by discussing picture 2, page 33. There are innumerable scars on this section of cliff, evidence of recent movement. Even in areas without scars, the cliff is hummocky, indicating movement which has been hidden by vegetation.*

*This is a good opportunity for children to begin acting as geographical detectives and to look for signs that a section of cliff might be moving, or about to move.*

*What children should appreciate is that two things are involved: the size of the cliff, and how soft the rock is. Clearly the waves have a certain amount of energy, so the taller the cliff, the bigger the bulk that has to be moved for a certain distance of retreat. Thus low cliffs are especially vulnerable. Again, for cliffs of equal size, a cliff made of hard rock will be far slower to retreat than one made of soft rock.*

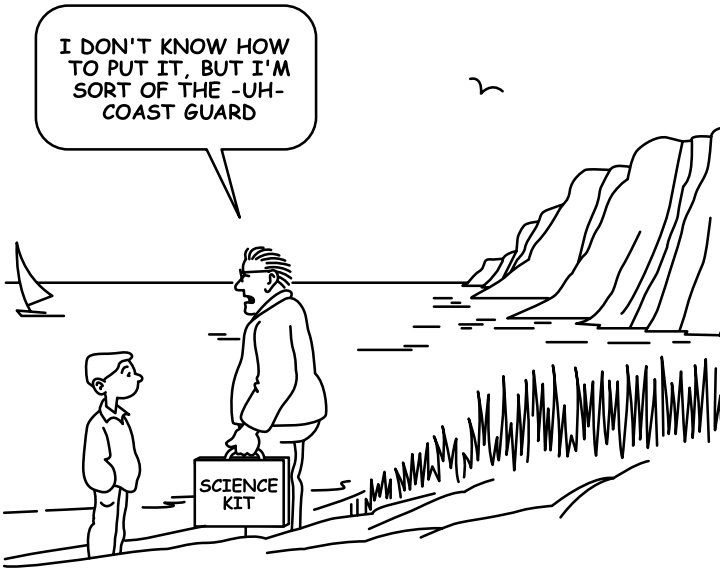
*People have traditionally liked to live by the sea, but this is not a good idea in vulnerable locations because it can cost far more to protect houses than the houses are worth. Sea defences, even for short stretches of coast, run into millions or tens of millions of pounds. Knowing this, children can start to discuss why it is good to leave a coastal strip without development.*

Name:..... Form:.....

See **pages 34 and 35** of *The Coast Book*

# Living by a stormy beach

**Beaches are built by waves. During storms, beaches can be completely overwhelmed by waves.**




**Q1.** Why would people want to live by a beach?

✎ .....

.....

.....

.....

**Q2.** What kind of foundations would houses need when built by a beach?

✎ .....

**Q3.** Can you think of a common building that is built on the beach.

✎ .....

**Q4.** What is the difference between the parts of the coast where people lived in the past and the parts they want to live in today?

✎ .....

.....

.....

**Q5.** Look at the cartoon. Can you think of how a scientist can be a kind of coastguard?

✎ .....

.....

.....

# 16 Answers, Notes, Background

See **pages 34 and 35** of *The Coast Book*

## Answers

1. **Because the sea is attractive and they may want to go swimming, etc.**

2. **Sand is a very soft, loose material that is readily washed away. To get any degree of stability, stilts are needed.**

3. **A pier. Many seaside towns have piers that have buildings on them. However, piers have a high risk of destruction from strong waves, as several recent collapses have demonstrated.**

4. **They wanted sheltered harbours in the past in order to protect their ships and fishing boats. Today they want beaches for leisure.**

5. **A scientist can find out what is happening to the coast and help people to understand the hazards better.**

## Notes

*In this section you get the opportunity to discuss risk. People often put themselves at risk. Sometimes this is due to ignorance (for example, they simply had not considered the difference between the summer waves they had seen while on holiday and the stronger winter waves) or they might not feel the risk is important.*

*In general, people who put themselves at risk also put others at risk and cause extra expense to the community when they have to be rescued. Putting yourself at risk and then expecting others to help you when you get into trouble can be considered an antisocial activity. Yet thousands do it.*

*The only way to prevent people putting themselves at risk is through planning controls. Planning controls, such as the prohibition of development in risk-prone areas, is the result of long term studies of what actually happens and so has a scientific basis.*

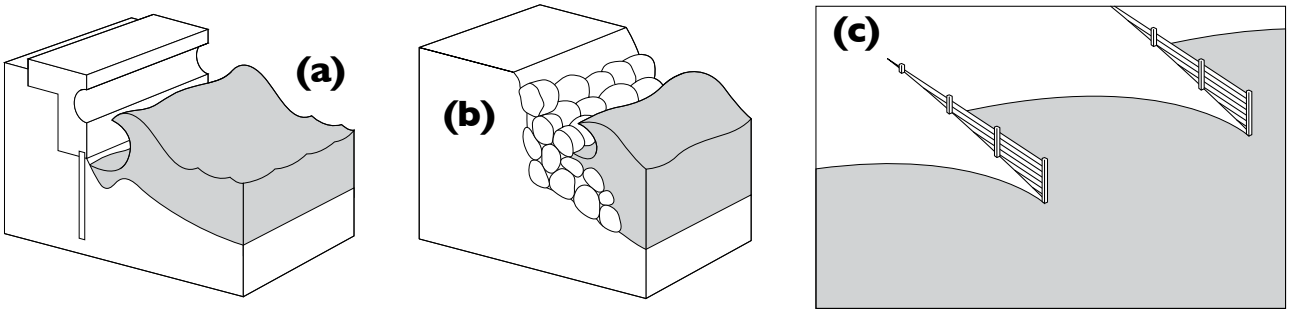
*Children might also like to consider that people in the past used the coast in a very different way from today. In the past, the coast was used as a means of earning a living and so people knew the area of the coast where they lived and how to stay alive. Today, with greater discretionary income, people can go to the coast for purely recreational purposes and such people have little knowledge of the risks. Furthermore, the part of the coast they want to use is completely different from in the past. Beaches were of little use to people in the past; they preferred sheltered harbours. Today the reverse is true.*

Name:..... Form:.....

See **pages 36 and 37** of *The Coast Book*

# Protecting yourself from the sea

**If you want to stop the waves eroding the coast, there are several ways to do it, some better than others.**




**Q1.** The diagrams above show you three ways in which you can keep the sea from a section of coast: (a) is a sea wall; (b) is a pile of large boulders too big for the sea to move; (c) is groynes placed across the beach.

Suppose you were the head of two companies, each wanting to convince a town to use one of these types of protection. Write down what you might say about each one.

✎ .....

.....

✎ .....

.....

**Q2.** Now put yourself in the position of someone concerned for the environment. What would you say against each of these ways, and which one would you feel caused least damage overall?

✎ .....

.....

✎ .....

.....

✎ .....

.....

# Answers, Notes, Background

See **pages 36 and 37** of *The Coast Book*

## Answers

1. **Here are some suggested answers. Others are, of course, possible.**

   **(a) The sea wall is as solid as a rock. It will last a lifetime.**

   **(b) Boulders are natural materials. They will allow the sea to break over them and use up all of its energy. They're also cheap.**

   **(c) Groynes will make the beach wider and so do away with the need for a sea wall or boulders. Instead, the waves will use up all of their energy breaking on the beach. They are also cheap.**

2. **(a) Sea walls are expensive and do nothing to soak up the energy of the waves. If the waves can't wear away the cliff, they will take the beach away instead.**

   **(b) Boulders are ugly and difficult to get over.**

   **(c) Groynes are ugly, and an eyesore and make it difficult to use the beach because it is broken up by the fences. They also trap sand that is needed on beaches further along the coast.**

   **Overall, the boulders are best from an environmental viewpoint.**

## Notes

*This topic allows children to put arguments for and against various alternatives, using information from The Coast Book.*

*Children might think that a sea wall is the best form of protection because it looks substantial, but if a defence is to work, then it must use up the energy in the wave. If it doesn't do this, then the energy will simply be transferred elsewhere. The best way of using up energy is to break up the wave. This can be done with boulders, or with a wide beach over which the water makes a large band of surf. A sea wall does little to absorb energy, and instead reflects the wave and its energy back out to sea. This is why so many beaches get washed away below sea walls.*

*The other concern is whether we should stop erosion at all. This is discussed on page 40 of the student book.*

Name:..... Form:.....

Based on **pages 38 and 39** of *The Coast Book*

# How should we use the coast?

**The coast is a precious resource for us all. At the same time, we want to enjoy it. Satisfying everyone can be a problem.**

**Q1.** Read the passages on pages 38 and 39 of *The Coast Book*. Now choose to be one of the people from the page. You can be a rambler, a retired person, a builder, a conservationist or a day-tripper. On the sketch above put a ring around the person you have chosen to be.

Choose one of the other people whose argument you want to speak out against. Put a cross on the sketch above to show who this is. In the space below say why you think this person is wrong.

✎ .....

.....

.....

.....

.....

.....

.....

.....

.....

# Answers, Notes, Background

Based on **pages 38 and 39** of *The Coast Book*

## Answers

1. **This depends on the choice of the students.**

## Notes

*This unit gives an opportunity for students to put themselves in the shoes of someone they agree with, and to argue against another point of view.*

*It may come as a surprise to some children that there is a conflict of interest at the coast. This point may need to be tackled before you proceed to consider points of view. You may think it is useful to show conflicts of interest closer to home. For example, suppose a developer wanted to build houses or a hotel on the school playground – would we mind?*

*There may be a tendency for children to want to be the conservationist, but it would be useful if they were encouraged to be someone else as well, perhaps by running the sheet twice. The more able might do this while the less able are still working on their first sheet.*

*This is also a chance for children to write a long piece and to read it out so that others can hear different points of view.*

*At the end some children may see that other people's points of view are valid. In this case they have made the major step of realising that the way forward is to find a compromise solution to problems. You could return to this topic with the last unit in the book, which discusses wildlife. Here you could say how it is possible to have wilderness areas in places that people do not want to be anyway (for example, away from roads) while allowing heavy development in easily accessible places.*

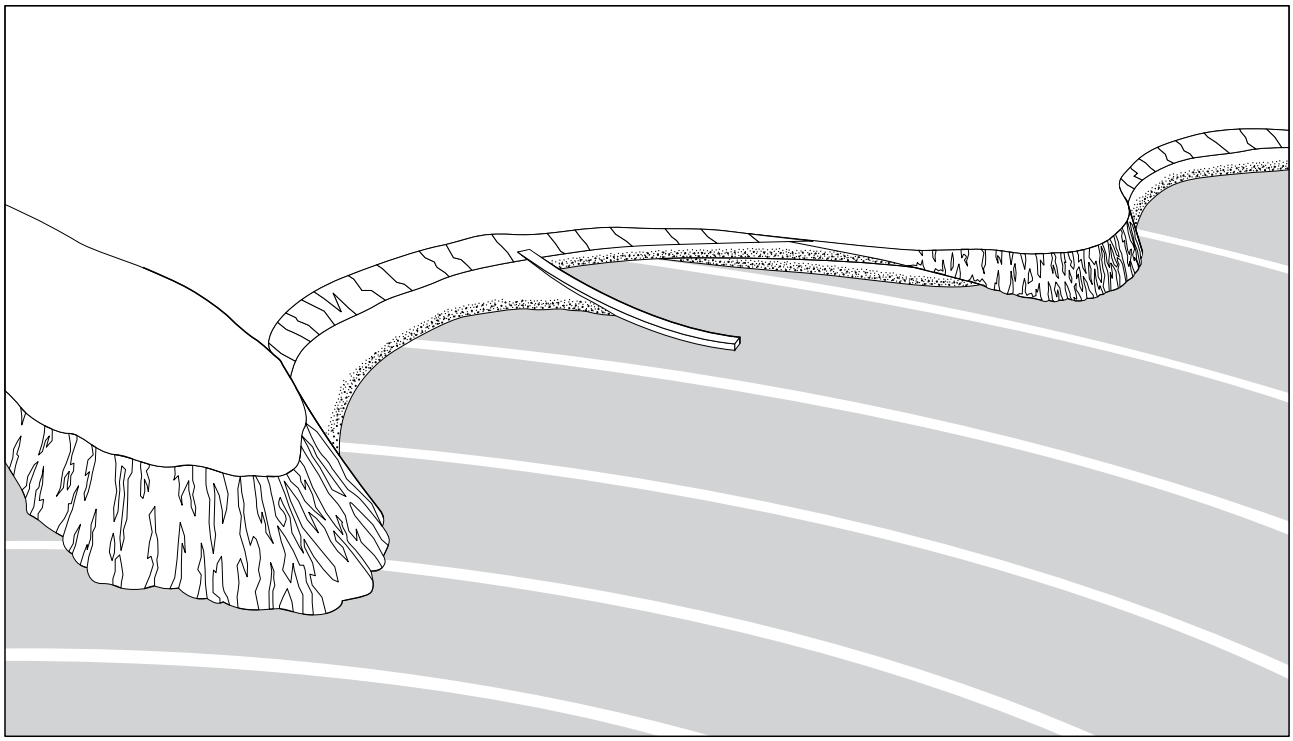
*You can also go on to include this idea in any fieldwork you might do at the coast. You could ask children to see if there appears to be any sign of conservation or wildlife protection. But bear in mind that much of this, if done properly, will be unobtrusive. For more ideas on this you can look at the books in the Science@ School series called '4B Habitats', '5B Life cycles' and '6A Adapting and surviving'. These are all available from Atlantic Europe Publishing.*

Name:..... Form:.....

See **pages 40 and 41** of *The Coast Book*

# Learning to leave the coast alone

**Sometimes doing nothing is better than doing something – but only when you understand what is going on.**



**Q1.** On the diagram, label the place where the land is eroding quickly.

**Q2.** On the diagram, draw in the direction in which the sand is moving.

**Q3.** What would happen if some beachside land was protected by a sea wall?

✎ .....

.....

.....

**Q4.** Why, then, does it make sense to let the headland erode and allow no building there?

✎ .....

.....

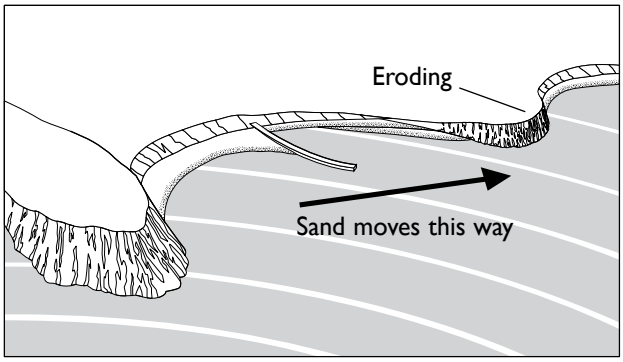
# Answers, Notes, Background

See **pages 40 and 41** of *The Coast Book*

## Answers

1. **See diagram.**

2. **See diagram.**




3. **The beach would begin to lose sand and the land behind it would also erode.**

4. **Because then you can allow building next to the sheltered beach.**

## Notes

*This unit is based on the idea that if erosion in one place means protection for another, we can divide up the coast into safe places to build and places that should be allowed to erode.*

*One of the most important places where these ideas have been worked through is East Anglia. Look at Blakeney Spit and Orford Ness, which are two spits. They both point in different directions, showing that longshore drift is moving west on the north coast and south on the east coast. The source of sand for all of the beaches is thus the extreme northeastern part of Norfolk. This area is eroding rapidly. If it were protected by defences, then all of the beaches along the rest of the East Anglian coast would be adversely affected, losing sand and eroding. So it is clearly far more cost-effective, and disrupts far fewer lives, to leave the eroding area alone and simply pay compensation to those few people whose land is eroded, than to have to build more and more protection for all of the other towns along the coast.*

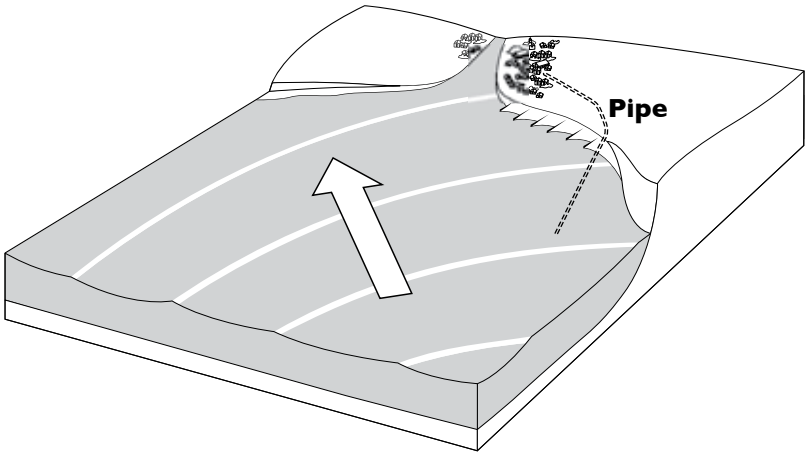
*In the end, it is important to see that science allows planners to make informed decisions about the environment and make plans which prohibit ignorant development that might later cause problems. It is far cheaper to identify the way the coast naturally behaves and work with it, than to work against it. After all, the waves will never get fed up, so the problem will continue forever and use up money that could better be spent elsewhere.*

Name:..... Form:.....

See **pages 42 and 43** of *The Coast Book*

# Beach pollution

**Anything dumped in the sea is pollution. But some forms of pollution are more dangerous than others.**




**Q1.** What is flotsam?

✎ .....

.....

.....

.....

**Q2.** What is one of the most long-lasting <u>materials</u> found in flotsam? (Use Picture 1, page 42 to help you.)

✎ .....

**Q3.** On the diagram above, draw in the path sewage would follow if it were discharged from the pipe.

**Q4.** What problems might discharging sewage at sea cause for the town?

✎ .....

.....

.....

.....

.....

**Q5.** Would it help if the sewage pipe were on the other side of the bay?

✎ .....

.....

.....

.....

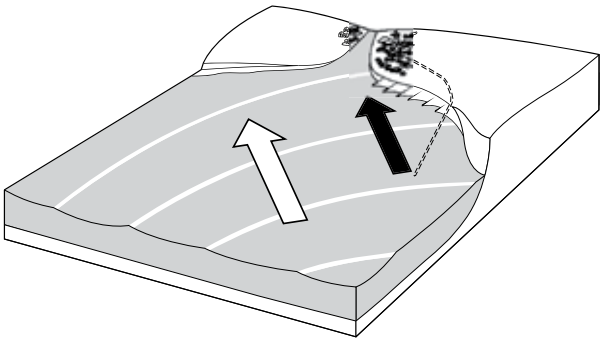
.....

# Answers

1. **Any solid material carried by the waves and currents and landed on a beach.**

2. **Plastic. The traffic cone, the buckets and tubs in the pictures are all made of it.**

3. **As diagram.**



4. **Sewage might get onto the beaches. People playing on the beaches or in the surf might drink polluted water or handle sewage and become ill. Sewage also smells.**

5. **It might help the town, but the sewage would simply go further along the coast and give someone else a problem, so the real answer is that it would not help overall.**

# Notes

*This worksheet considers waste from homes. We have not considered materials such as heavy metals, that might be pollutants from factories, because these will not be familiar to children.*

*The first thing to show is that waste travels. Thus it is very important to look at flotsam, and also make it clear that this is just the floating part of the waste. What about all of that left on the sea bed? Also, children should realise that much waste is not biodegradable, especially plastic. So a combination of light weight and indestructibility make plastic flotsam a real problem.*

*Having discovered that flotsam proves that the waves and currents can carry solid wastes long distances, children can then understand that dissolved or suspended matter can easily be carried just as far, but in this case it cannot usually be seen.*

*Children need to see that a knowledge of the way waves and currents work is vital in showing why sewage should not be discharged into the sea. They need to be told about germs, and this might form a link with science unit 6B Microbes and you may care to refer to the Science@ School book '6B Microbes' published by Atlantic Europe Publishing.*

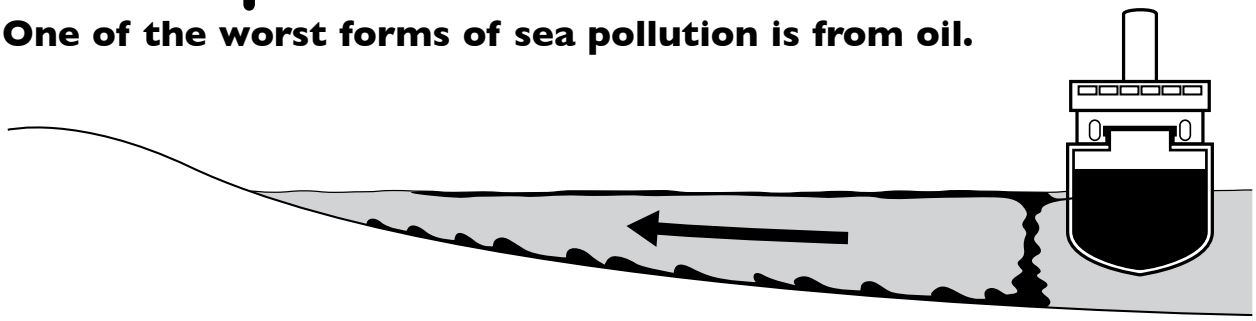
*Finally, it is important that children realise that such material is not just a local problem, because material can travel far. For example, sewage dumped into the sea in one location can result in contamination of a large area around.*

Name:..... Form:.....

See **pages 42 and 43** of *The Coast Book*

# Beach pollution

**One of the worst forms of sea pollution is from oil.**



**Q1.** What is the name for oil that spills out across the surface of the sea?

✎ .....

**Q2.** What is the name for oil that sinks to the sea bed and eventually rolls up on the beach?

✎ .....

**Q3.** What are some of the first living things to be affected by oil?

✎ .....

.....

**Q4.** Much of the oil floats on the surface. If you were part of a disaster control team trying to collect the oil, how might you try to do it?

✎ .....

.....

**Q5.** Think of the oil as a dirty-coloured cooking oil. Imagine this coating birds and other animals and suggest how you might remove the oil. (Hint: think of how you get grease from dirty plates when you wash them up.)

✎ .....

.....

.....

.....

.....

.....

# Answers, Notes, Background

See **pages 42 and 43** of *The Coast Book*

## Answers

1. **Slick.**

2. **Tar balls.**

3. **Birds and the animals that live on or just under the sand of a beach.**

4. **Because it floats, oil can be trapped by booms and sucked up with giant vacuum-style cleaners.**

5. **Oil can only be removed by emulsifying it, that is by breaking it up into tiny balls that are surrounded by detergent. This can then be washed away. On page 43, the people seen on the oiled beach after the Valdez disaster are doing exactly that, using hot (not cold) water containing detergent under high pressure.**

## Notes

*Oil pollution is one of the most intensive forms of pollution (although sewage pollution described on the previous page is a much more serious worldwide problem). Oil pollution interacts with both people and wildlife. Its horrific effects are often shown on TV. Details of one of the most famous disasters, the oil spill from the Exxon Valdez in 1989, can be found on these web sites:*

*http://www.valdezscience.com*

*and*

*http://www.oilspill.state.ak.us*

*Oil pollution takes the form of a very concentrated release of pollutants that do not mix with water (sewage mostly dissolves in water). The oil is a mixture and comprises a number of substances, some of which float to produce the oil slick, and others of which sink to the bottom and form into dense balls of heavy oil known as tar balls. While people worry about the oil slick because its effects on spoiling a beach are immediate and obvious, the effects of heavy oil sinking to the bottom can be even more devastating. When oil sinks, it can cover up bottom dwellers and kill them. As the bottom dwellers are part of the food chain, many other animals along the food chain are affected if bottom dwellers are killed.*

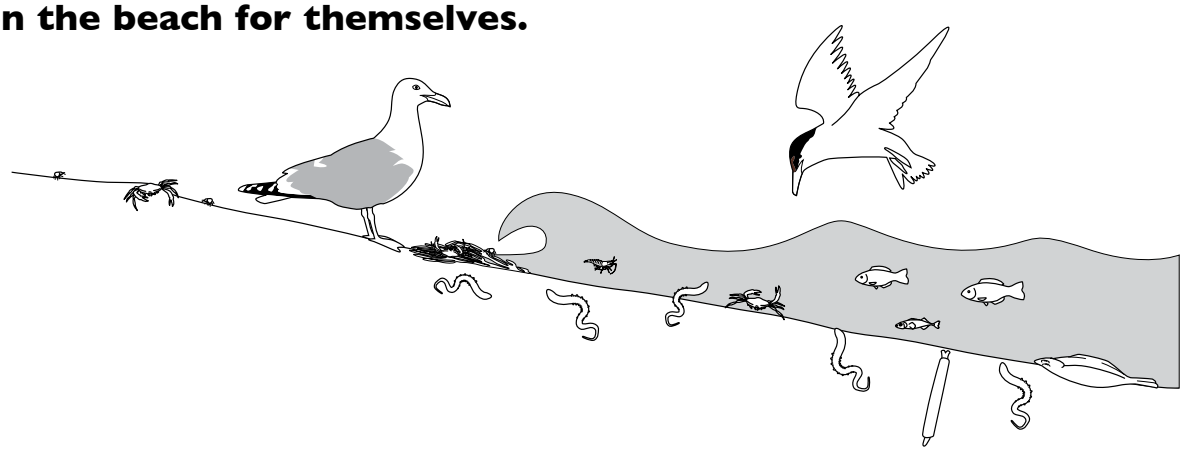
21A

Name:..... Form:.....

See **pages 44 and 45** of *The Coast Book*

# Wildlife at the coast

**Humans are not the only living things to live by the coast. Birds and a great variety of beach-dwellers also seek the best homes on the beach for themselves.**



**Q1.** Two common birds are found close to breaking waves. Write down their names. (Use Picture 1, page 44 to help you.)

✎ .....

**Q2.** Suggest a reason why the birds choose this spot.

✎ .....

.....

.....

**Q3.** Name three other animals which also come to the shore in search of food.

✎ ..... ✎ ..... ✎ .....

**Q4.** Many birds that hunt for food on the beach do not live there. Why do you think birds do not live on the beach?

✎ .....

.....

.....

**Q5.** Many birds nest in cliffs. What is the attraction of the cliffs?

✎ .....

.....

# Answers, Notes, Background

See **pages 44 and 45** of *The Coast Book*

## Answers

1. **Gull, tern.**

2. **Because the breaker zone disturbs the sand and exposes many beach dwellers that are food for the birds. Many bottom dwellers also rise from their burrows as the tide comes in, whereas during low tide they are way below the surface and out of reach.**

3. **Fish: herring, sprat, cod, plaice.**

4. **Because it is an unstable area with tides coming and going. It is also very exposed to attack from predators.**

5. **They are safe places away from predators and close to fish food supplies. (They are also good places from which to take off, requiring less effort than taking off from the land.)**

## Notes

*This unit gives the opportunity to link science with geography and study the distribution of some coast life. This would also link in well with a field trip. The unit is split into two parts; that dealing with the beach and that dealing with rock pools. Rock pools are discussed on the following page.*

*Children can begin to notice that birds do not fly at random, but are searching for their food for most of the time. The food source is mostly bottom dwellers, many of whom live in the tidal zone. The tidal zone puts these sand-living creatures in shallow water for part of each tide, while breaking waves disturb the sand and throw up lots more creatures. This is the point at which they become available to fish and birds. Other birds, with specially adapted bills, also use the tidal zone, but they use it just at the edge of the breaking waves, making use of the fact that it is easier to stick a bill into saturated sand than into sand that compacts as it dries. Coastal marshlands can be particularly rich in these waders.*

*Children should also notice that many birds search for food on the beach, but then nest in cliffs where there is better security.*

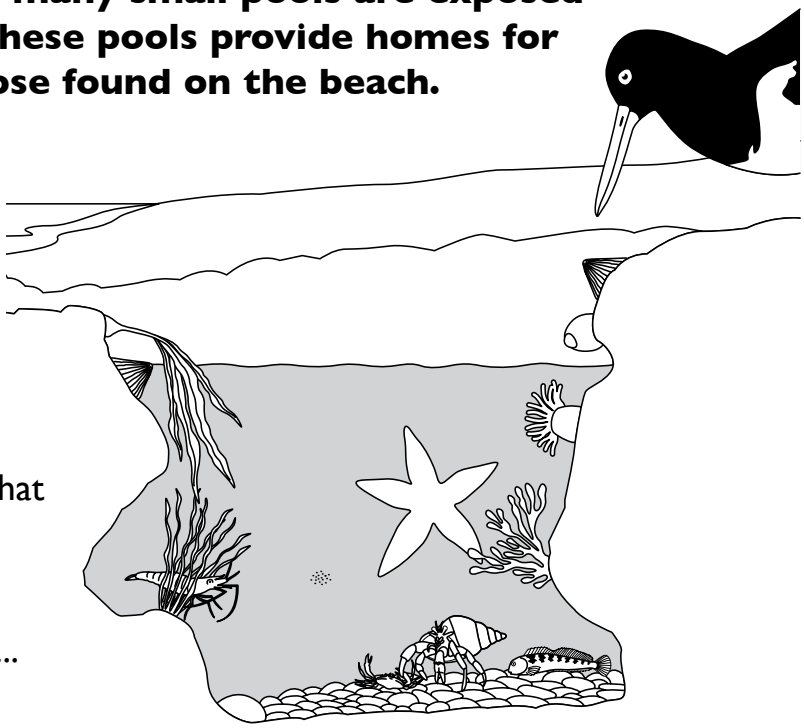
*When considering how to use the coast, as discussed on page 38, consideration should be given to the needs of wildlife. Some places are preserved as conservation or wildlife areas. If any of these are located near your field trip area, they would be well worth a visit.*

Name:..... Form:.....

See **page 44 to 45** of *The Coast Book*

# Wildlife at the coast

**Where the coast is rocky, many small pools are exposed and hidden by the tide. These pools provide homes for different species from those found on the beach.**



**Q1.** On the diagram, label in their correct places, the limpet, seaweed, blenny and sea anemone. (Use Picture 3, page 45 to help you.)

**Q2.** Limpets have a hard shell that fits tightly on to the rock. What use is this kind of shell?

✎ .....

.....

.....

**Q3.** Why can the blenny successfully live in a rock pool?

✎ .....

.....

.....

.....

**Q4.** How does the sea anemone change between low and high tide?

✎ .....

.....

.....

.....

**Q5.** Some birds are adapted to feed in pools. How is the oyster-catcher adapted?

✎ .....

# Answers

1. **See Picture 3, page 45.**

2. **The shell is designed to protect the limpet from breaking waves, as well as to keep moisture in when the tide is out. It also offers some measure of protection against birds. This is why limpets can be found in places by the shore that dry out whereas, other animals, such as starfish, are not.**

3. **The blenny is good at spotting predators and is well camouflaged.**

4. **As the tide goes out, the sea anemone contracts into its rubber-like case. The diagram shows how it sends food-gathering tentacles out when it is submerged.**

5. **It has a chisel-like bill.**

# Notes

*Rock pools occur in some places where hard rocks have been planed off by waves, but the waves are, in general, too fierce to allow sand to settle (all beaches have rocks just below the surface, too, but the sand covers them).*

*Pools vary in their richness. Those furthest away from the sea simply receive splashed water from breakers and some rainwater. They are usually the ones that are poorest in life.*

*As you go closer to the low tide line, the pools become richer because they receive new water supplies each day, and with these come the microscopic plankton that are the bottom of the sea food chain.*

*Children should be encouraged to compare the environment of the beach with that of the rock pool and see the different distributions and strategies that the living things adopt in these different environments. For example, in a beach where there is no shelter, the animals bury themselves in the sand. In a rock pool there is no deep sand, but there are usually stones to hide between.*

*More information on this topic can be gained by using the Science@School books published by Atlantic Europe Publishing, particularly the ones titled '4B Habitats' and '6A Adapting and surviving'.*

# Section 4: Fieldwork guidelines and worksheets for fieldwork

## Take care by coasts!

It is easy to visit coasts with children so that they can see for themselves many of the landshapes described in the student book. But remember, members of your party can stray, and waves, tides and cliffs can be dangerous, so never take risks near deep water, or go near the coast in stormy weather. Please always follow your Local Education Authority or school safety code.

This next section is really quite personal. It is based on over 20 years of taking field trips. You may have your own way of doing things, but at least reading mine will give you something with which to compare what you do. As you will find, my rule for keeping a coach load of children under control is to keep them engaged. There is nothing better than thorough preparation of the route, as well as the location, for achieving this.

Students need to have a set of activities to accomplish, so they will visit all aspects of the coast and not find themselves with nothing to do at times. There are, after all, many other attractions at a coast, and a constant flow of action is the only way of ensuring that pupils make the most of this opportunity for work outside the classroom.

Visiting the coast is often an expensive outing that may not occupy more than a day. Planning for the best use of time is therefore crucial, and prior investigation is essential. We have all seen bunches of children standing about asking questions from a questionnaire that has little meaning to them because it has not been put into context, even if the teacher thinks otherwise.

The key to making the most of a day or more at the coast is for the pupils to know the plan and the overall scheme and for this to be drilled in to them. In this way they will already be clear as to what they need to be doing at each moment and why they are doing it.

Security is also a concern, so a site should be chosen that is compact and manageable. You want children to have some scope for working on their own, but they still need to be within sight and reach.

A visit to the coast is going to involve both physical and human aspects of geography, as well as science and history. This should be kept in mind when considering where to go. Furthermore, you may need to consider whether you are going

**▼ Lighthouses are fascinating for their mechanics, but they also offer the opportunity for looking at a headland and asking why the lighthouse is located there (remains of stacks off the shore, for example). In this way you can relate the lighthouse to headland processes.**

to lead the party or let someone from a field centre do it. Running the field trip yourself has the advantage that you and the pupils will have worked together and you will share a common experience that you can carry back to the classroom. Letting someone else run fieldwork does not have any of these advantages and so can be thought to lessen the overall experience for the children, even if it is easier work for the teacher.

▲ **Try to get a high level view of the coast. This cliff top view (which had security railings!) allows you to see patterns in the waves and also, if the sea is calm, to see how the beach shelves away. This is one way to learn something of the wave patterns even when it is calm. If the weather is stormy, then watch the pattern of waves breaking.**

## Stage 1: Deciding on the location

If you have not been to a certain place for a long time, or if this is the first time you have planned a coastal trip, it is worth taking some time to think about the best location. There are logistical reasons for making a choice, based on the cost of transport, time to get there and so on, but within an area there are often a number of choices of location.

### Example: the Whitby area

Whitby is one of the most used coastal resorts because it has a wealth of low-priced accommodation and a variety of types of scenery.

Although Whitby is quite a small town, as British towns go, and an excellent base for accommodation, it is a large place for a field trip. Ask yourself whether it is the best location for your daytime fieldwork needs. There are, for example, two small centres close by, both of which are more self-contained, and so easier to supervise, than Whitby. To the north is Staithes and to the south is Robin Hood's Bay.

Staithes and Robin Hood's Bay have single street access so teachers can more easily ensure that pupils do not stray.

Furthermore, it is a safer place to allow small groups to investigate on their own (depending on age, and so on).

Ask yourself if there is anything important about coastal processes, both human and physical that cannot be done

▲ **Aim to find somewhere with interesting cliffs, particularly those with many layers of differing hardness.**

in a small location. Very often the answer is no.

The temptation to use a large centre is that there is apparent variety. On the other hand, a small centre can be examined in detail, and detail makes for the development of better investigative skills. The fieldwork suggestions below are all based on small-scale investigation in the view that if children can first be persuaded to look in detail, then they will be more able to develop a broad view later. Physical processes are, in any case, almost always better looked at in detail.

**▲ Get children to stand on the beach and look landwards. This is what they would see at Robin Hood's Bay: lanes converging on the ramp used to draw the boats onshore and houses side-on rather than face-on to the wind. A resort town would, of course, exhibit a very different pattern.**

## Planning from the classroom

If you have ever seen the famous film 'The Dirty Dozen', you will know that the formula for getting people of a wide range of abilities to work effectively is for them all to know exactly what they are doing, what everyone else is doing and why they are doing it. There is no suggestion that the children should be taught by numbers, as in the film, but the same planning and explanation is crucial.

Children need to know what they are expected to get out of their field excursion. You need to be able to tell them in a series of points. For example:

"❶ We are going to see how the waves work. Now we have tried watching waves in a tank in the classroom, but we have not yet been able to see a breaking wave.

❷ We are going to see where people use a beach. Our class book gives us a picture of one beach, but do you think that is really what happens on all beaches? We shall try to find out."

... and so on.

In this way children can see that there is a point to the fieldwork and that they are expected to collect information for a set of well-defined goals. Each of these goals will, in time, be matched by a worksheet which they will be expected to fill in as they do their fieldwork.

**◀ When the tide goes out, children can see the rocky base on which the beach is formed. The curved lines here show the eroded surface of a dome. There are lots of similar things that can be spotted from the cliff tops.**

## Planning for the weather

You cannot do much about the weather, so it is best to plan for activities that can always be done despite it. Think of those things that are very weather dependent, such as surveys of visitors. On a wet day few people may visit the coast and children will get fed up standing about in the wet, so it might be

best not to plan for this. By contrast, children can always study waves, do beach profiles, plot the location of hotels, shops, etc. They may get wet, but they will at least be on the move and less likely to get miserable.

Planning for the weather also means making sure the children are well equipped for the weather. If they have waterproofs or wind cheaters they are less likely to be miserable than if they are cold or wet.

## Don't forget the tide

If you get down to the coast and find the tide in, the day may be ruined from the point of beach activities. So don't get caught out. If your field trip day is fixed and cannot be moved to when low tide occurs in the middle of the day, then don't plan for fieldwork that needs it.

Draw the fieldwork from the textbook. The fieldwork is best if it is an extension of the topics in the textbook and not simply a duplicate of it. If the field trip is planned well ahead, children can also be told about it before the classwork begins, and in this way they can begin to get excited. This will help in concentration and involvement.

The textbook has 21 topics, so there are potentially 21 different themes that can be investigated. This is quite enough for any field trip! Added to that, you can combine it with fieldwork that supports *The Settlement Book*, for settlement studies and the like.

# Stage 2: Put the location in context

You can do many things with a field trip, both before and afterwards. In the run up to the field trip, when children are probably unfamiliar with it, you can tell them about the location on a national and regional level. You can also show them its location from a road atlas and from a Landranger 1:50,000 or 1: 25,000 map. You can also see if you can find it in an atlas. If not, get the children to explain why not (limitations of mapping small places, etc).

**▲ If your coast has small settlements, try to find out how they are placed with regard to the prevailing winds, and therefore the prevailing waves. Do they use one end of a bay for shelter?**

## Find out about the history

Children are going to go to a place that has developed both through geological time and historical time. First, ask yourself what rocks are at the coast. On your own private reconnaissance, you can collect some small samples to show children. Then tell them about the history of the rock. How many million years old is it? What is it made from (link to Properties of Materials in the science curriculum). Does some of it feel softer than others?

There are now many local history booklets on specific places. It is also possible to find out something about almost any place from the Internet. This provides a link for ICT skills.

If the Internet information is all about hotels, then ask the children why this is so. What implications can they draw from this for the kind of place they will be visiting?

Get children familiar with how buildings have changed through the ages. Can they recognise old and very old buildings?

Can they recognise size? What would it be like to live in a place where the rooms are 3.5m x 3.5m and just one up and one down (as fishermen's cottages, for example).

## On the way down and back

A field trip to the coast often involves long journeys and children should be kept occupied for at least part of this, if for no other reason than to stop them pulling one another's hair. It is also an excellent opportunity to play eye spy for geographical features.

If the teacher has prepared a list of features for children to find, then they can be told when each one is coming up. This can be on any theme of geography, not necessarily related to coasts. For example, you could also include river studies.

Here is one example:

> "We are now coming to point 8 on your sheet. Notice we are looking for a stone bridge over the river (coach slows down to make sure everyone can see it). Now you have to write down the number of arches."

The point here is to encourage children to look out of the windows and to observe detail. It's not just a bridge; it has 9 arches. Why? Because the form of construction needed lots of arches, or the river is wide, many arched bridges are old, and so on.

One point every ten minutes or so will give 12 points on a 2hr journey, and 12 more on the way back.

**▲ If your field trip beach has boulders or breakwaters, get children to find out how people use them, ignore them or avoid them.**

## Take photographs beforehand

Everyone knows it takes time to get your bearings, so you have to help children to do this in a structured way. This is easier in a small place than in a large place.

Taking some photographs beforehand will let children familiarise themselves with some aspects of what the area looks like. Labelling 5 or 6 buildings, or other features, and putting them on the search list worksheet will help when you get to the destination.

You can also see that for this to work, the place you visit has to be attractive and therefore enticing. A display of pictures on a wall can help children look forward to the trip even more.

**▶ Children can find out where the oldest buildings are. This will give them the location of the core of the coastal settlement. An abbey, such as the one here at Whitby, is easy to spot, but old piers and old houses (as below the cliff) are easy for children to distinguish as old, especially if some streets are cobbled.**

## Start with a perspective

It is usually very difficult to get a perspective from within a location. Rather than just driving down to a beach, it might be better to find some location which provides a vantage point, or choose a route that gives the best perspective.

## Example: Swanage

You can come into Swanage from the land, in which case you don't see the coast until you are through the middle of the town. But you can also approach it from the bay, so that by the time you reach the heart of the town the children already associate it with the sea. Furthermore, you can drive out on to a headland and look back to get a view of the bay. There is no need to dwell on this, but making sure children associate location with coast is vital.

For orientation and mapwork you can then ask:

"Where are we now – north, south, east or west of the centre?"

"How do we know?"

Look at shadows (link with Light in the science curriculum) to find out.

**▲ Find a cliff with bands of rock (this is Lulworth Cove) and get children to tell you which rocks they think are hard and which are soft. Or take photos and blow them up so the children in the classroom can try to pick out differences from the photographs.**

## Take care near cliffs!

Do not go near to unstable cliffs. Do not have packed lunches below cliffs. Keep a respectable distance from tall cliffs. Do not go near clay and other soft-material cliffs in wet weather, or at any time during winter. The cliffs may collapse without warning. (You may see older children working by cliffs. They should all have hard hats on. As hard hats are not appropriate for young children it is best to stay away from the foot of cliffs.)

## On arrival

Once you have arrived, make sure that everyone has all of the worksheets they need. On each worksheet should be the school's name, the child's name, the telephone number of the school and your mobile number if you have one. Also write the location of the coach/minibus, etc, so that if a child should get lost, then at least any piece of paper they have can be examined by a responsible adult who will immediately see the contact details.

You then need to make sure everyone knows where everything is. It is best to find a coach/minibus location which is exceptionally easy to find, not one in some obscure back street. Park on the sea front if at all possible. Then give the children an orienteering lesson on where the car park is with respect to other landmarks. This should also go on to a worksheet. This is important, even if you intend that all children should be with you at all times. You never know what unforeseen problem may separate a pupil from the group.

## Start at the sea

This is a coast excursion, so to begin with, don't confuse it with information on anything else. Use the traditional system of

**◀ Dunes are good fun, but do not let children go onto areas where there are signs of high erosion.**

**▼ Try to find places where erosion of soft rocks is really apparent, as here in Lincolnshire. Children can then consider the impact of erosion in the light of present or future land use, such as the caravan site shown here. Get children also to understand that this low cliff is easily eroded because it has a small volume.**

physical first and human after. Go down to the beach and start the physical activities. The physical activities are discussed in detail on each appropriate page earlier in this guide.

Begin with the sea and the waves and then work in towards the land. In this way the causes of many of the land features become apparent.

You should also plan to visit the beach on two separate occasions, one on arrival and the other on departure. In this way children will be able to see the way the sea comes in and goes out and see how features become exposed or covered up.

If you have a choice, pick a date when your arrival will coincide with low tide, so that all of the physical activities can be done straight away. Then, on departure, the tide will have come in and the beach can be looked at again.

Here is a sample plan for a day at the coast:

1. The waves are produced by the wind blowing against the water, so get children to sense the extra windiness at the coast. Even on a warm summer's day you may experience a sea breeze.
2. The waves come into the beach and the beach gets shallower, so the waves grow in height. Get children to look out to sea and notice that there are no lines of breakers away from the coast. Waves with long crests (breakers) appear as water moves onshore.
3. The waves change shape. Get children to look at the way the waves change shape as they approach. They can also count the number of times waves break in one minute (remembering that storm waves are more frequent than fine weather waves). There is also our old adage that "every seventh wave is a big one". Children could test this out in terms of how far the swash reaches up the beach.
4. If the beach and weather are suitable, now is the time to become involved with the water. It is especially good to get children to take off their socks

and shoes and get their feet wet. Feeling the water gives a better sense of involvement with the water.

▲ **Children need to get to recognise different types of waves. These are spilling waves with no curling breaker.**

5. Get them to squidge their toes about and feel how easy the sand moves, then they can start to concentrate on how the water moves past their ankles. You are trying to get them to appreciate swash and backwash as well as foam. No one need stand in deep water for this. Ankle deep is quite enough. Get the children to walk down with the backwash and up with the swash, so they get the rhythm of the waves. Then they can stand still and focus on the sand moving around their feet.

6. They can also try using small round objects to look for any sign of longshore drift (but remember this drift is small and in enclosed bays may not work at all, so it is best if you have tried this out on your reconnaissance visit to save disappointment on the actual field trip).

7. Now, having had fun running in and out with the waves, children may be ready to look back from the sea towards the beach. They should still be standing in the surf for this, so they can feel the water. This will help them to focus on the beach and imagine themselves as waves. The back of the beach is higher than the lower beach so they should see the beach rise up in front of them.

▼ **With fine weather and low waves, it is alright for children to experience running in and out with the waves, as this primary school field trip was doing in Yorkshire. Note that it was well supervised, with teachers as well as the children in the surf.**

Do they see any features in the beach? Are there ridges, troughs or ripples? The important point here is to get them to look at detail. An explanation of how these features came to be is not important (and often complex), but the idea that a beach is not uniformly flat sets children off on the path of noticing small differences.

8. While they are in the surf, they should collect a small sample of sand in a plastic bag to take back to class.

9. This is also the time to start to collect shell fragments, look for signs of worm casts, crabs or any other form of life.

10. Children can also look for birds on the beach. Birds will always be there for a reason. Point out that they are there because the beach contains food. So where is the food? Children can also look out for seaweed. They can, at this point, also note that the sea does not contain the equivalent of grass. You might introduce the idea of plankton, which we cannot see, being the bottom of a marine food chain, rather than vegetation, as on land.

11. On some beaches there will be pebbles. Everyone should collect a pebble and start to handle it. Make sure they see that it is smooth and rounded (but not ball-shaped). Remind them about abrasion, where the pebbles might have come from and so on. Children should each keep a small pebble for later study in class.

12. Now look for any man-made features. Groynes are found on many beaches, so a groyne can be investigated to see if there is more sand on one side than the other, and thus make conclusions about longshore drift.

13. Now children can examine the back of the beach. It may be made of sand dunes, a sea wall or natural cliffs. Cliffs and sand dunes give more opportunity for investigation than sea walls, so bear this in mind when choosing a field trip location.

14. Can children see any rounding effects of abrasion from pebbles being thrown against the cliff by the waves? Does the cliff bottom look smooth, or feel smooth?

15. Children can now examine the beach for flotsam, and try to identify where it is located (at the high tide limit). They might also look at (but not touch) some flotsam and identify its material (usually plastic or wood). They can then comment on disposing of plastic materials at sea.

**◀ One way to show that waves break on the beach at an angle is to make use of any groynes that may be available. The wave angle shows up much better here than on an open beach.**

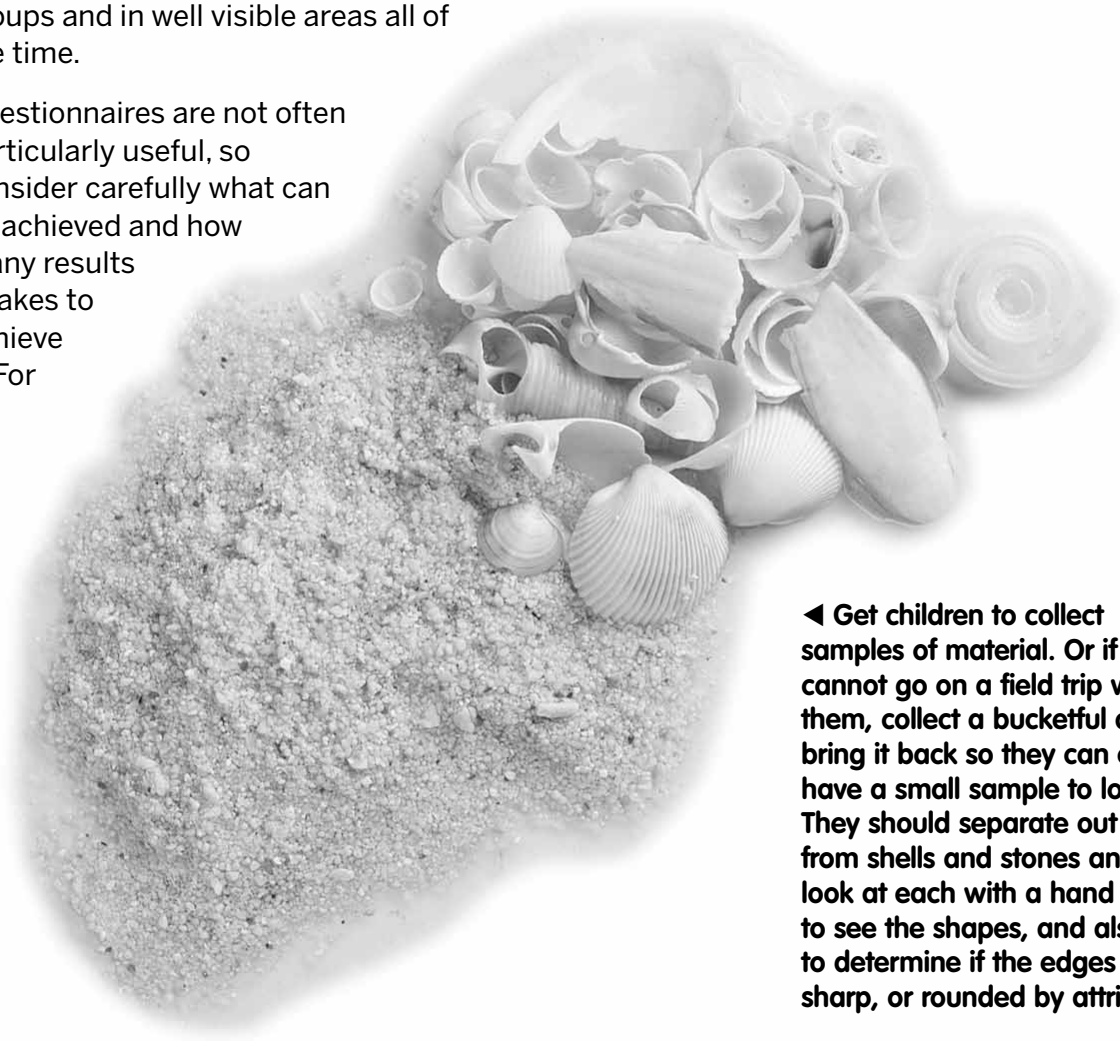
16. Having covered most of the physical aspects of the beach, children can then turn their attention to the way people use the beach. Where do people go on the beach and what do they do on each part of the beach?

17. From the beach, children can examine the services that are close to the beach. Where are the toilets, the shops, the hotels, the attractions? Where is parking possible? These are easy to plot on a simple map to give an idea of seafront activity. Do not make this survey too long, or children will get bored.

18. Some children enjoy asking strangers questions based on questionnaires. Some children hate it. Do not force children who hate it to do this task, and make sure that all children are in groups and in well visible areas all of the time.

    Questionnaires are not often particularly useful, so consider carefully what can be achieved and how many results it takes to achieve it. For

**▲ Ripples form when waves move over fine sand. You can demonstrate this in a classroom by using dry sand and a hair drier. There is not much difference between waves and blowing air. Alternatively, you can show how sand dunes might form from wind-blown sand.**



**◀ Get children to collect samples of material. Or if you cannot go on a field trip with them, collect a bucketful and bring it back so they can each have a small sample to look at. They should separate out sand from shells and stones and look at each with a hand lens to see the shapes, and also to determine if the edges are sharp, or rounded by attrition.**

▲ Get children to count the pieces of flotsam. If you have a basket and a scale, try weighing the amount along a metre of beach, and then getting children to multiply this up by the beach length to find out the total weight of flotsam on the beach.

example, if half of a class of 30 each asks one question, there are 15 results (for example, "Where do you come from?") and this is enough for later class use. Subjective questions should be avoided (such as, "Do you like it here?").

## It's time consuming!

What has been listed here will take several hours, and at no time have the children moved off the beach (except to visit the toilet or have refreshments). But what they have achieved is varied.

The key is to keep changing topic, but always build the topics in order, so that children learn things in progression as far as possible.

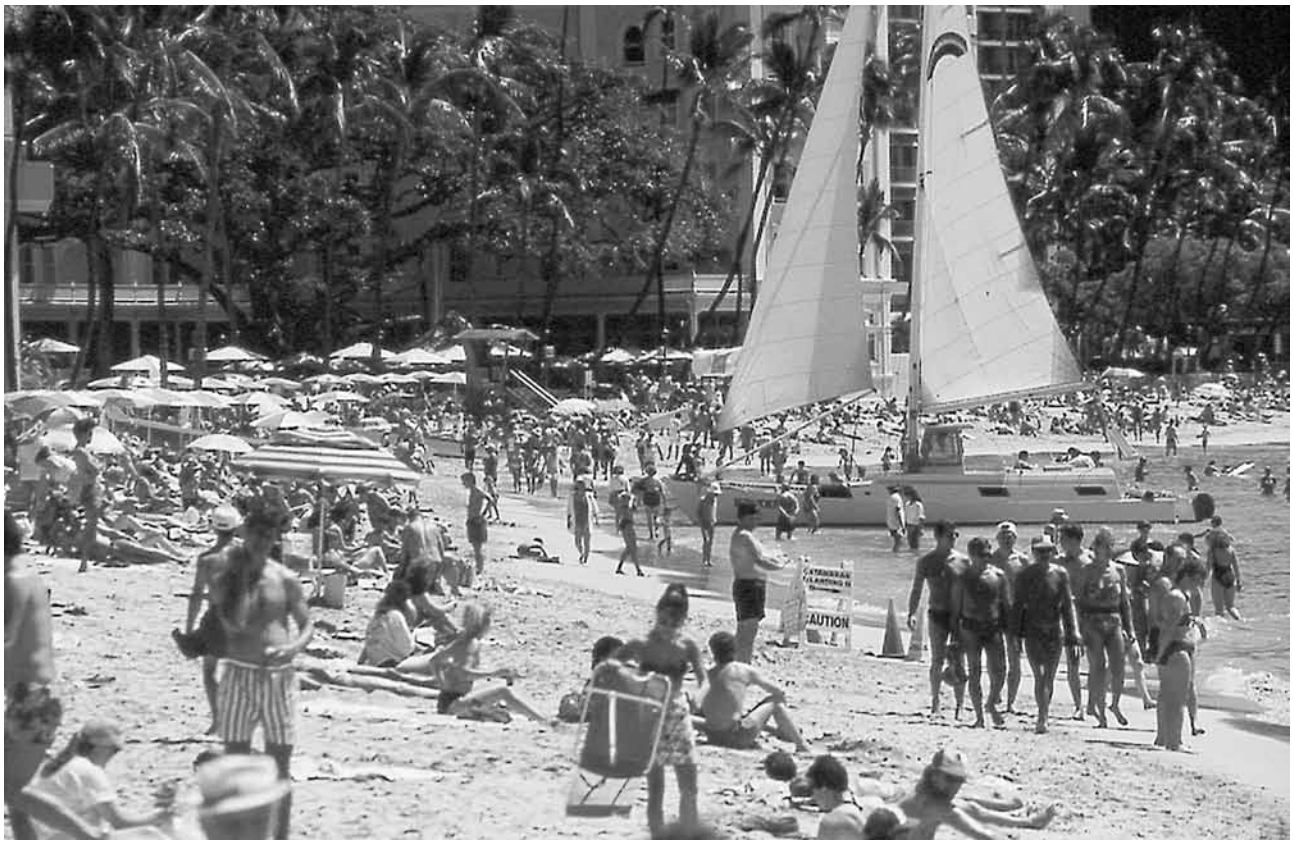
One way of making sure children have focused on the main events is to get them to tick a 'seen it, done it' worksheet. One is provided here if you wish to use it. The objective of this worksheet is to get children to check off simple tasks and also to make simple drawings.

▼ Children could try to find unusual houses and say why they think they are like this. Is it because the land close to a pebbly shore is cheap, for example?

▶ **Children can plot the location of outdoor games such as push and put. Are they close to the beach, up on the cliff or elsewhere? Children can also try to find out if different people use these facilities from those using the beach.**

▼ **Get children to stand in the busiest part of the beach and then look around. Do they find themselves close to hotels, shops or a car park?**



# Fieldwork worksheets

Here is a suggested workbook made up of continuous questions. It begins with physical geography, then links to science and eventually to human geography and social issues.

It may be used directly, or you may wish to amend it. You will find the file for use on your computer in the form of a Word document at:

**www.CurriculumVisions.com**

Select 'Coasts' and then 'Extras'.

Name: ✎ .....

School: ✎ ..... School's tel number: ✎ .....

Mobile contact number: ✎ .....

**Make your way down the list answering the questions on the sheet.**

I have seen a lighthouse. It was called:

✎ .....

On the beach there was some evidence of black tar. It looked like:

✎ .....

Here are descriptions of three pieces of flotsam I saw:

1 ✎ .....

2 ✎ .....

3 ✎ .....

The name of the beach I visited was:

✎ .....

The name of the town closest to the beach is:

✎ .....

At the back of the beach there were (*tick any that you saw*):

Sand dunes ☐ Cliffs ☐ Sea wall ☐

Something else ✎ .....

Name: ✎ .....

School: ✎ ..... School's tel number: ✎ .....

Mobile contact number: ✎ .....

## Headland/cliff

*(relates to pages 8-9, 12-13, 14-15 and 16-17 of The Coast Book)*

I saw a headland. It was called:

✎ .....

This is a drawing of what the headland looked like when seen from the side:

Close to the headland I saw a (*tick as many as you saw*):

Cave ☐ Arch ☐ Stack ☐ Needle rock ☐

The cliff had none of these ☐

The shape of the cave I saw was: Round ☐ Slot-like ☐

The rocks nearby sloped the same way as the cave walls: Yes ☐ No ☐

Name: ✎ .....

School: ✎ ..... School's tel number: ✎ .....

Mobile contact number: ✎ .....

In the headland I noticed the rocks in the cliff were in layers:

Yes ☐ No ☐

The layers seem to be: Flat ☐ Sloping ☐

I saw a place where some rocks had fallen out of the cliff and made boulders at the cliff foot:

Yes ☐ No ☐

**Bays/Beaches**

*(relates to pages 8-9, 22-23 of The Coast Book)*

The bay I visited was: Circular ☐ Wide and open ☐

This is a drawing to show what the bay looked like.

Name: ✎ .....

School: ✎ ..... School's tel number: ✎ .....

Mobile contact number: ✎ .....

The back of the bay had a:

Cliff ☐ Sand dunes ☐

I collected a sample of the sand to take back to class:

Yes ☐ No ☐

The beach had some pebbles on it. This is a tracing of one of them done by placing the pebble on the paper and drawing around it.

I kept this pebble to take home: Yes ☐ No ☐

The waves on the beach were:

Crashing down into the beach ☐

Spilling forward over themselves ☐

Name: ✎ .....

School: ✎ ..... School's tel number: ✎ .....

Mobile contact number: ✎ .....

I counted the number of waves that crashed in a minute.

The number was: ✎ .....

This is a drawing of what the wave shape looked like from the side:

I stood in the surf and felt the water moving past my toes. ☐

I felt the incoming water pushing against my toes as I looked out to sea. ☐

I felt the outgoing water pulling against my heels as I looked out to sea. ☐

I walked in and out with the moving water. ☐

The waves came up the beach: Straight on ☐ At an angle ☐

Name: ✎ .....

School: ✎ ..... School's tel number: ✎ .....

Mobile contact number: ✎ .....

I stood in the surf and watched the sand move past my toes:

As it came in ☐ As it went out ☐

I placed a small, round piece of wood on the sand by my toes and watched how it moved. This is what happened:

✎ .....

✎ .....

✎ .....

✎ .....

✎ .....

✎ .....

✎ .....

✎ .....

✎ .....

✎ .....

✎ .....

The beach was largely made of:

Mud ☐ Sand ☐ Pebbles (shingle) ☐

The beach seemed: Almost flat ☐ Quite steep ☐

I looked to see if there were any shells on the beach, or pieces of shells.

Yes ☐ No ☐

Name: ✎ .....

School: ✎ ..... School's tel number: ✎ .....

Mobile contact number: ✎ .....

I collected a piece of shell. This is what it looked like:

I looked to see if there were any worm casts on the beach, or small holes that might tell of animals hiding below the surface:

Yes ☐ No ☐

I looked around to see if there were any birds nearby: Yes ☐ No ☐

I saw some birds:

Out to sea near the breaking waves ☐

In the air over the beach ☐ On the cliffs ☐

These are what I thought they were:

✎ .....

Name: ✎ .....

School: ✎ ..... School's tel number: ✎ .....

Mobile contact number: ✎ .....

I looked at the plants growing on the land close to the beach. These are drawings of what I found:

Name: ✎ .....

School: ✎ ..... School's tel number: ✎ .....

Mobile contact number: ✎ .....

## Making use of the beach

*(relates to pages 26-27 of The Coast Book)*

This is a map of my part of the beach. It shows these places: Beach ☐

Hotels ☐ Toilets ☐ Shops ☐ Car parks ☐ Restaurants and cafes ☐

I asked a person on the beach:

(a) "Where have you come from?" ✎ .....

(b) "Why are you visiting the beach today?"

✎ .....

# Further notes on fieldwork

## Sampling on a beach

Beaches can be more complicated than you might at first think. Try taking a 1m square frame of wood with you to act as a sampler (it can be smaller if you wish); it can also be made of four metres of string which you knot into a continuous loop and lay out into a square. The point is it is a sampling device.

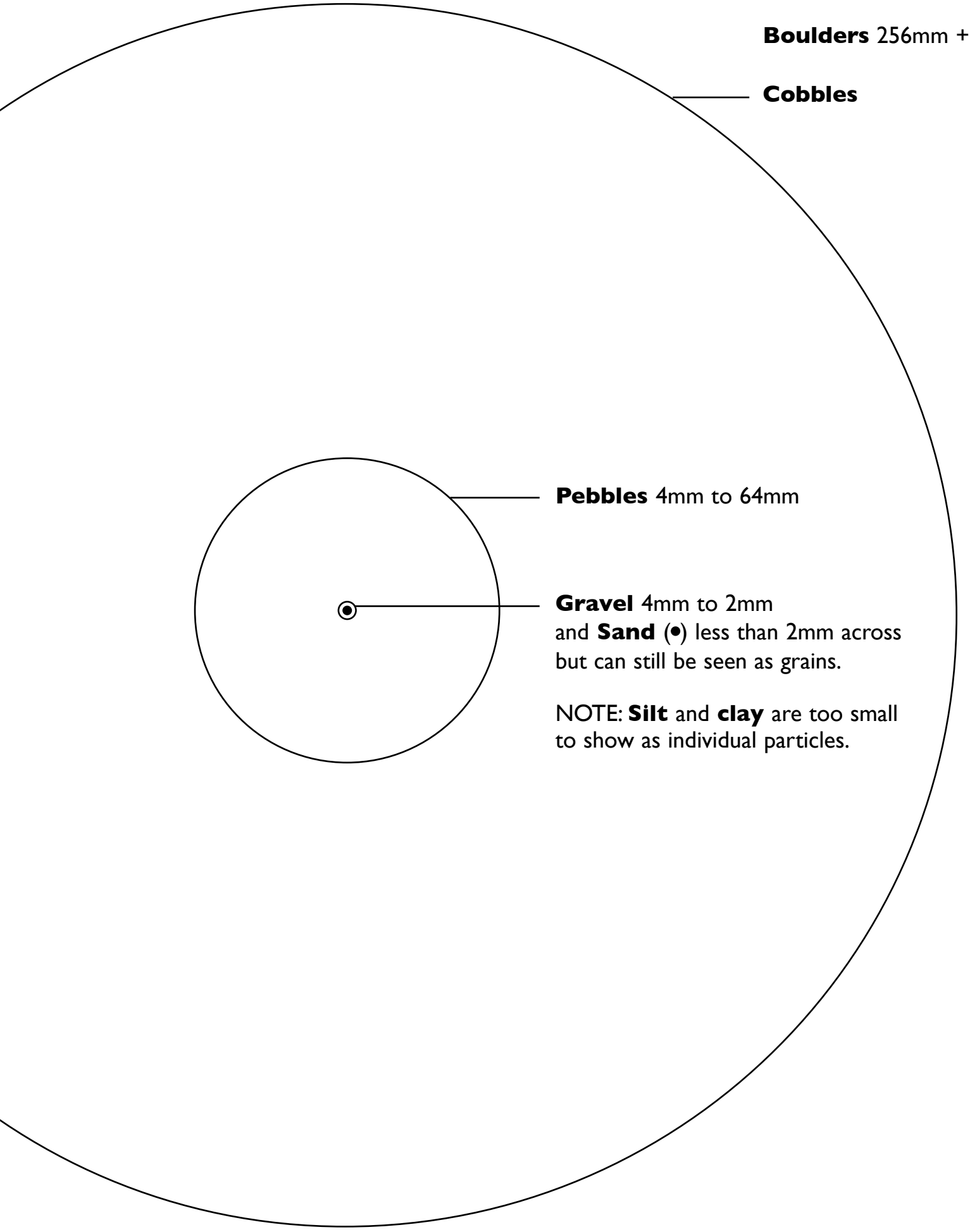
You might find nothing but sand, or nothing but pebbles of all the same size, or you might find a mixture of the two. From the point of view of trying to get children to sort materials, it is best to go to an area where you know there will be some variety.

Having got your square, get the children to sort out the large materials from within it and put each kind of material onto a separate piece of paper, or in a separate bag. Collect only material from the surface. Do not dig down.

If the children are able to do this in pairs, then you will get a number of results which can be compared.

The most sophisticated way to find out the proportions of larger materials is to use a nest of sieves. However, a cheaper way would be to mark circles on a sheet of paper or use the template given here and photocopy it.

Children can then be asked to find out which particles lie entirely within the circles on the template. Then, when they compare their results, they will have a standard to go by.



# Getting to love a pebble

One important aspect of fieldwork is to get children to look at the detail of their world. By looking at the detail, they can often make better judgements about the big picture later on.

To this end, get every child to choose and hold a pebble. It should be one they have chosen, even if the pile comes from a bag you have collected from the coast and are using in class.

The idea is to look at the pebble and get more and more familiar with it.

The first thing is to notice its weight, simply observing that it is heavy. Now have them drop the pebble and watch it fall quickly.

Next, have them drop the pebble in a deep bowl of water and notice that it drops more slowly. Here we begin to show children that the processes in the water are different from those in air. In fact, a heavy pebble is partly supported by the water (this is Archimedes principle of buoyancy and can link to the science curriculum on Forces).

You can tie a fine thread around the pebble and then make a hook in the other end of the thread and hang it from a science force meter. Start with the pebble in air and then lower it into the water. This will show the reduced weight of the pebble (weight is a force). Once the students know this, you can tell them that it is easier to move heavy pebbles about when they are in water, and they can begin to imagine how waves, and even currents, can move sediment more easily than we might think.

Now we can look at the shape of the pebble. It is not completely spherical. Why not? Discuss the random shape of debris from a collapsed cliff as a possible cause for the strange shape of the pebbles.

Notice that any sharp edges have been worn away. If the pebbles have sharp edges then they have not been in the water very long.

In general, rounding of pebbles occurs because of pebbles rubbing against one another (called attrition). The way it works can be shown by using a pebble polishing machine that tumbles pebbles with a mixture of water and an abrasive like corundum in a cylinder.

Once pebbles are rounded off they tend to remain round because the attrition then works evenly over their entire surface.

## Evidence of beach life

It is possible that children might find a crab or some other small animal while they are walking on the beach. This is where to look:

1. Search at low tide to see the worm casts. You may not see the worm, but at least there is evidence that they are alive and this helps children to visualise how many other creatures, such as clams, are there, too.

   Look especially on flat parts of the beach where there are ripples and standing water. Not only may you find worm casts, but you may find small crabs. There are lots of places I have visited like this. The Wirral is one good place.

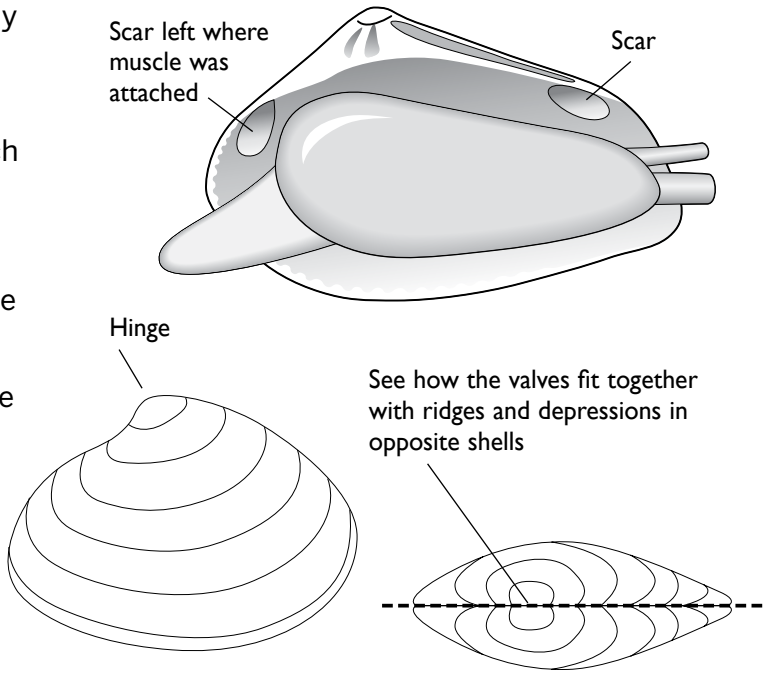
2. In the creeks marginal to an estuary. The small waterways that drain an estuary contain water except at the lowest tide. There will be limited activity by animals until the tide begins to turn and flows back in. At this time crabs will appear and you may see shrimps and other animals. However, do be careful not to get cut off by rising water. Ynys Las spit near Borth in mid Wales is one good site where the estuary is not filled with treacherous mud.

If you can't see any evidence of active life, then you may care to walk along the beach collecting shells. You can often identify more shells at low tide than at high tide, especially on wide beaches such as at Blackpool or Southend.

Children will find mainly single mollusc valves, but this gives the opportunity to explain why. When these creatures are alive they have two intact valves, which they protect from damage by mostly hiding in the beach and out of the way of breaking waves. When they die, the connecting tissue on the hinge between the valves rots and the valves fall apart.

If children are interested in molluscs, you can also point out for them how the valves fit together with ridges and depressions in opposite shells. You can also identify the circular scar where the main muscle was attached (see diagram).

If you cannot go to a beach and see this, then visit the fishmongers and get some oysters or other shellfish and prise them




open to see how the muscles are attached and give children some idea of what the creatures that live in the shells look like.

The range of shells that can be found is obviously evidence of the species to be found locally. The shells are not very robust and would be broken up if carried far by waves. Children do not have to identify special shells (although razor shells are quite distinctive, for example), they simply have to find as many 'types' as they can, including colour differences. This will get children looking more and more closely at the shells to make their classification. They may decide, for example, that the pattern of ridges on the outer shells differs, or the ridges and grooves near the hinge line are different.

The samples collected can be piled up to give an idea of the most common species.

## Survey the profile of a beach

Beaches vary considerably in their profiles. This is especially true of those beaches with steep sections near high tide. Many beaches on the south of England are like this, but they are not alone.

You do not need sophisticated equipment to do this job. But it is helpful to have a level and a hinged piece of wood. After that, you can pace off for distance to stop children from taking so long that they become bored.

The real point is that any kind of measurement is better than none at all.

The crudest form of measurement is simply to get children to pace down the beach from the back of the beach to the low tide limit. They decide if the slope is very steep, steep, medium, gentle or flat. They then pace off down the beach, finding out how many paces before very steep changes to steep, then how many more paces before it changes to medium and so on. What they are trying to establish is that beaches are steeper near their high tide lines than near the low tide line. This is simply a way for them to establish distances for themselves. They also have to make value judgements about steepness.

If children are on very steep beaches they will doubtless find berms (ridges) as well as troughs on the beach. They may also find a number of ledges down the beach. These will be high tide levels of a falling tide. After a few days of rising high tide, a beach will have many fewer features.

## Find out if some parts of a beach are steeper than others

If you visit a small, curved bay then it is easy to find out if all the beach is the same steepness, or whether some parts are steeper than others. Exposure is the key here, the most exposed parts of a beach being steeper than those in the shelter of a headland. You can see the same thing in bays that are wide, but you may have to confine what you do to an area near the headland at one end, preferably near the end protected from the prevailing winds.

You are not looking for huge changes, but children may notice the change in steepness as they walk along.

The steepness of a beach is matched by the size of material it is made up of, so one way of finding out if there is a change in beach steepness without having to measure the beach slope is to sample the material of the beach. You will need to collect a small bag of material from each of several locations, being careful to get children to choose the same part of the beach, label each one carefully, and at the end of the collecting process, you can spread the samples out on a sheet of paper in their correct positions relative to one another and see if there is any change in size. You may also use this as an exercise for getting children to measure material against a template (see page 121 for a template).

The use of material to look for changes in steepness is an interesting exercise, because it shows that natural processes are very sensitive indicators, and although we might not be able to see a change with the eye, a change in material size will tell you that there is a real difference.

## Looking at tide lines

As the tide comes and goes each day it causes the waves to wash up the beach at different heights. During the period between a neap tide (the lowest high tide and the highest low tide) and a spring tide (the highest high tide and the lowest low tide) every high tide will be higher than the one before it. Under these circumstances the waves will advance over those of the previous day and wash away any features produced. By contrast, the time between a spring tide and a neap tide means that the high tide is lower each day and so the features produced remain untouched.

Beaches with shingle show these changes most clearly. On a rising tide, the waves tend to push everything ahead of them. As each rising tide is lower than the one before it, the result is to build a set of broad ridges on the beach.

By looking for ridges like these, and looking at the flotsam on them, you should be able to persuade children that the waves and currents are really at work causing change.

## Day by day change

One thing you can do if you are at the seaside for several days, is to take pictures of the beach at the same place each day. You should also include waves in this picture.

If the weather changes from fine to storm, then the waves will change shape, becoming more upright and plunging more steeply down onto the beach. Fine weather waves are lower and broader and their surf spills forwards.

A set of pictures will show you if the waves have changed, and these can be displayed in class.

Storm waves on a falling tide can comb back a lot of material from a shingle beach. This is much more clearly seen by comparing photographs.

You could also tell children that this sudden change will be reversed by the next period of fine weather when all of the material combed away by the storm waves will be pushed back up again.

You could also tell them that the sudden 'loss' of a beach that often concerns those who live near the sea, is not something to get really concerned about and is only a short term loss.

## Quicksand

It might be helpful to explain how quicksand works and why you should stay clear of such regions. However, most areas of quicksand are rather shallow and quicksand deep enough to swallow a person is rather rare.

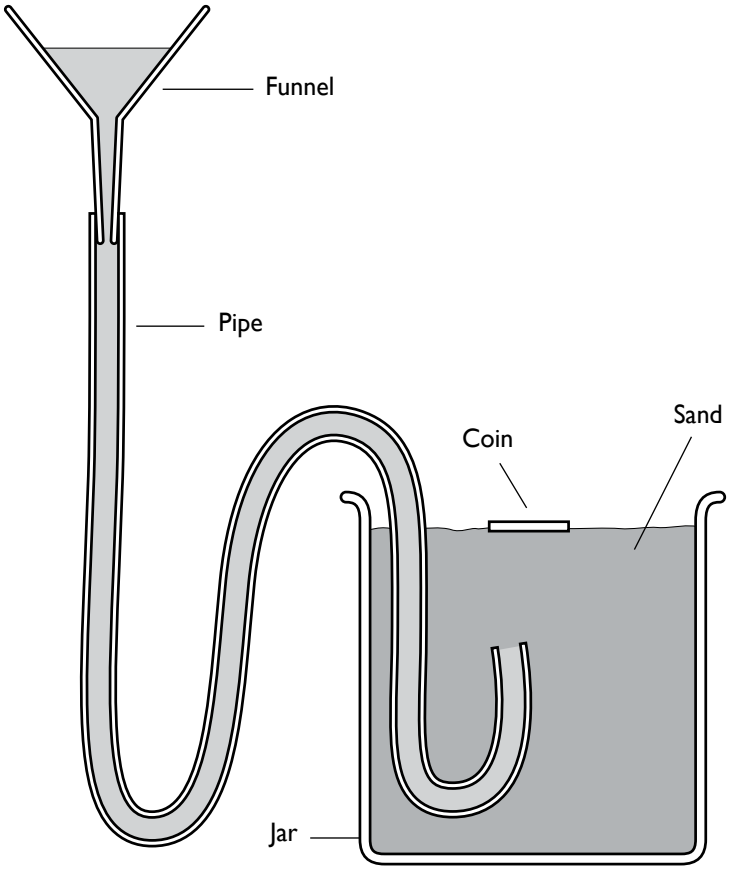
The study of quicksand can also be linked with Forces in the science curriculum, because it is an example of buoyancy.

To illustrate quicksand, get a clear-sided jar and put a plastic tube into it with the end of the tube standing upwards, as shown in the diagram, then fill the jar with sand. The other end of the tube is fitted with a funnel. Water will be poured into it. Alternatively, the tube can be connected to a water tap.

Fill the jar nearly to the surface with water. Add the water by pouring from a second jar, do not pour water through the tube at this stage. The clear-sided jar allows children to see the water films between the sand grains. Do not flood the jar. Place a coin on the surface of the sand: it is easily supported. Continue to add water from the jug. Even when the jar is filled with water the coin will not sink, although it might be easier to push it in.

What has happened at this stage is that the water is helping to buoy up the sand grains and so they press less heavily on one another. However, this in itself does not produce quicksand. For that the particles of sand have to be completely separate. In effect, the sand has to become a suspension.

Now is the moment to pour water into the tube. The coin immediately begins to sink. This is because the extra water is producing an upward force that is separating the sand grains and putting them into suspension in the water. In this state, the suspension has no strength and the coin sinks.



# Section 5: Text crosswords with answers

**Name:**..... **Form:**.....

See **pages 6 to 11** of *The Coast Book*

# Coast crossword 1

① (down) The edge of the land (page 6)

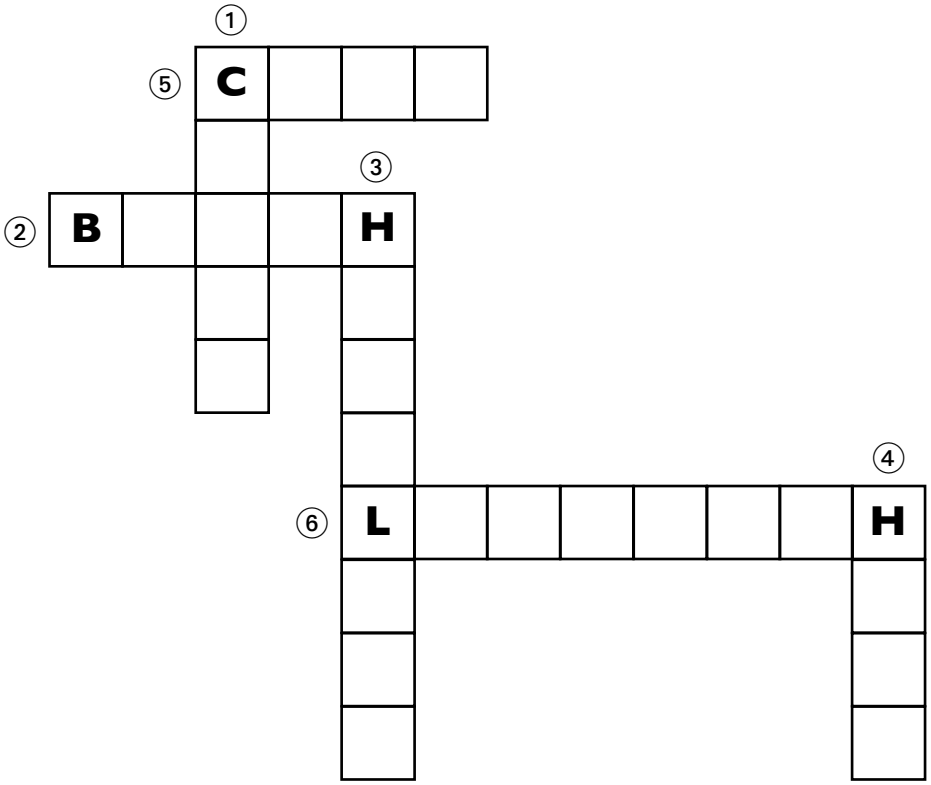
② (across) A sandy strip of land (page 6)

③ (down) Juts out to sea (page 8)

④ (down) The type of rock that makes a headland (page 8)

⑤ (across) Small bay (page 10)

⑥ (across) A place with a famous circular bay (page 11)

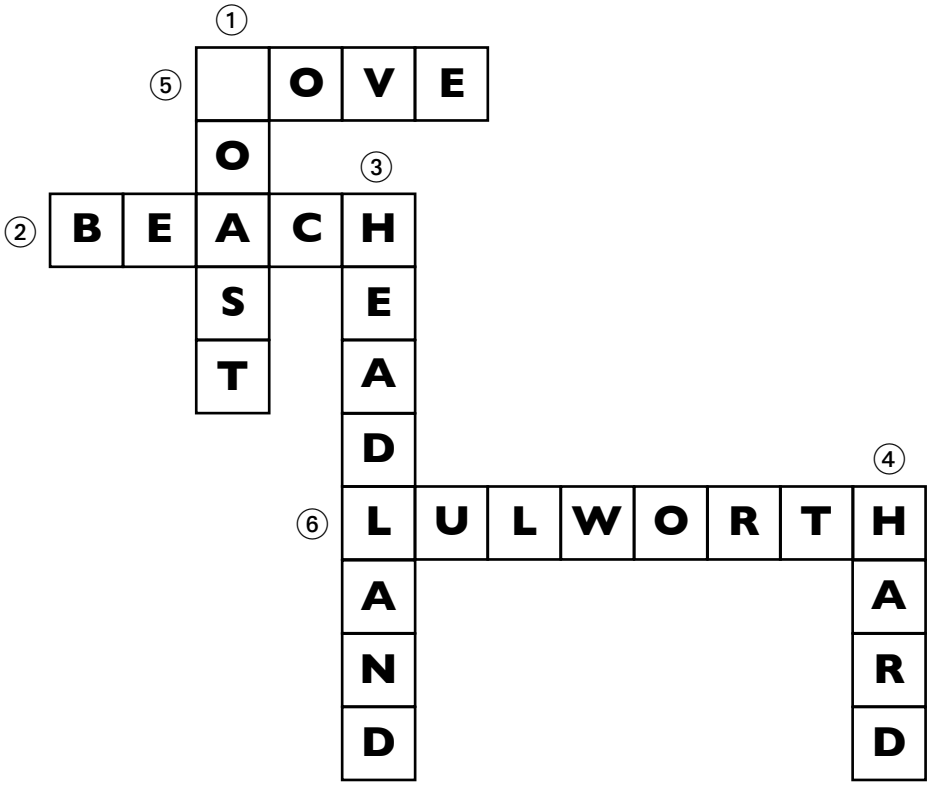


# Crossword Answers

See **pages 6 to 11** of *The Coast Book*

## Answers to crossword 1



Name:..... Form:.....

See **pages 12 to 17** of *The Coast Book*

# Coast crossword 2

① (down) A tall part of a coast (page 12)

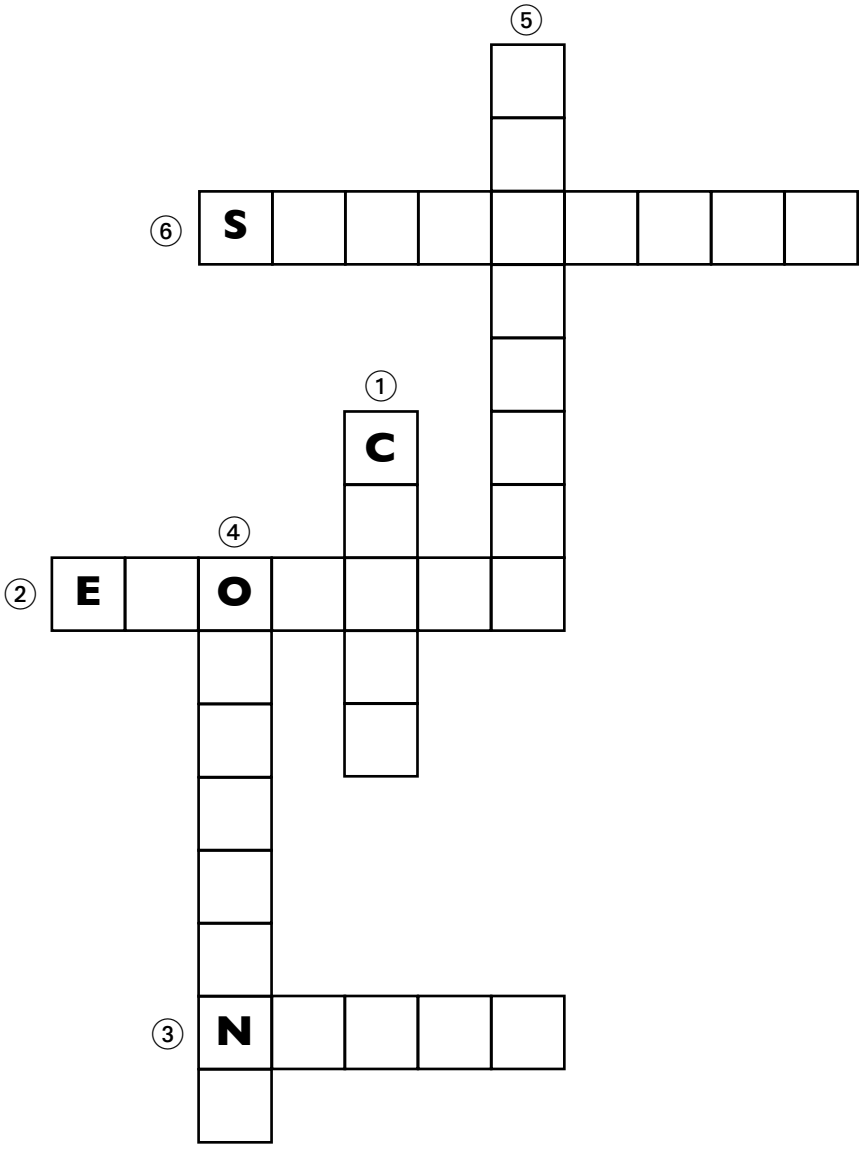
② (across) The wearing away of a cliff (page 12)

③ (across) Where the cliff base has been worn away (page 15)

④ (down) Cliff where blocks have been removed (page 13)

⑤ (down) Wearing away of a cliff by sand and pebbles (page 14)

⑥ (across) The shape of a cliff with soft and hard layers (page 17)

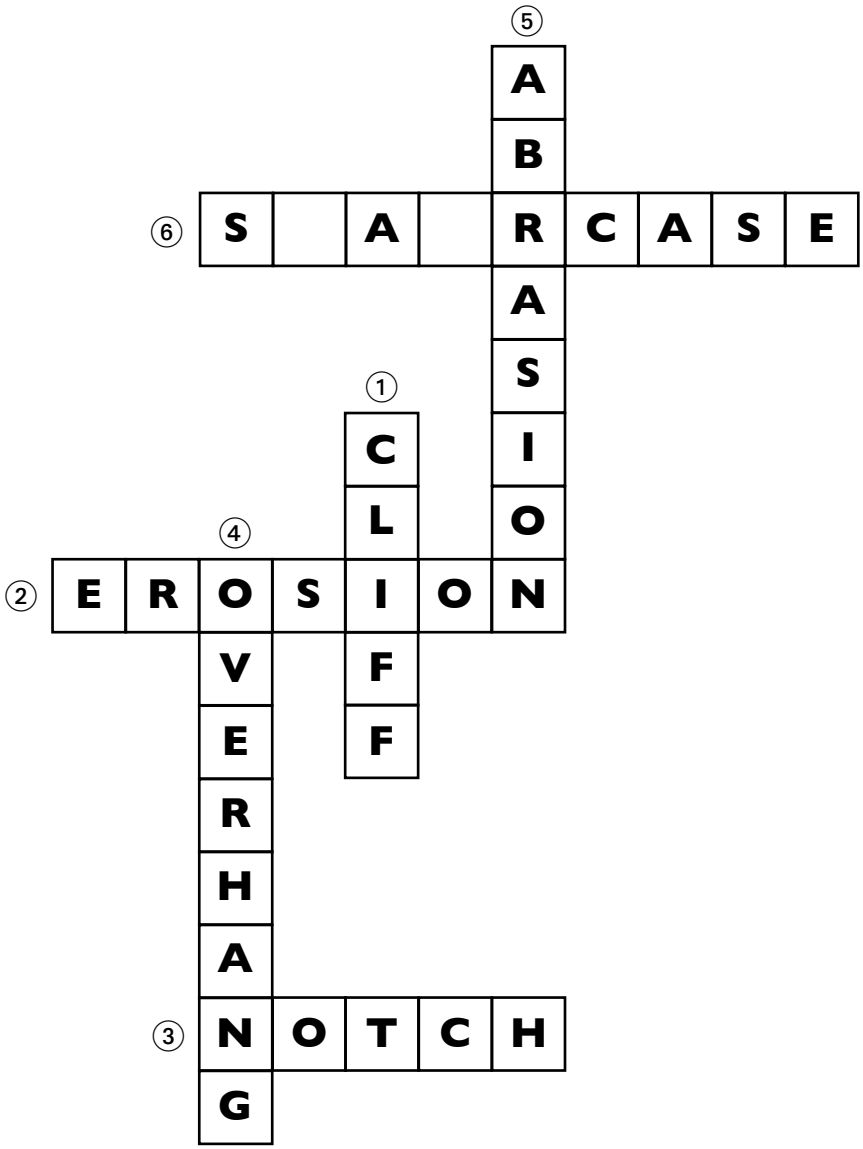


# Crossword Answers

See **pages 12 to 17** of *The Coast Book*

## Answers to crossword 2



**Name:**..... **Form:**.....

See **pages 18 to 21** of *The Coast Book*

# Coast crossword 3

① (down) When air blows through the roof of a cave (page 18)

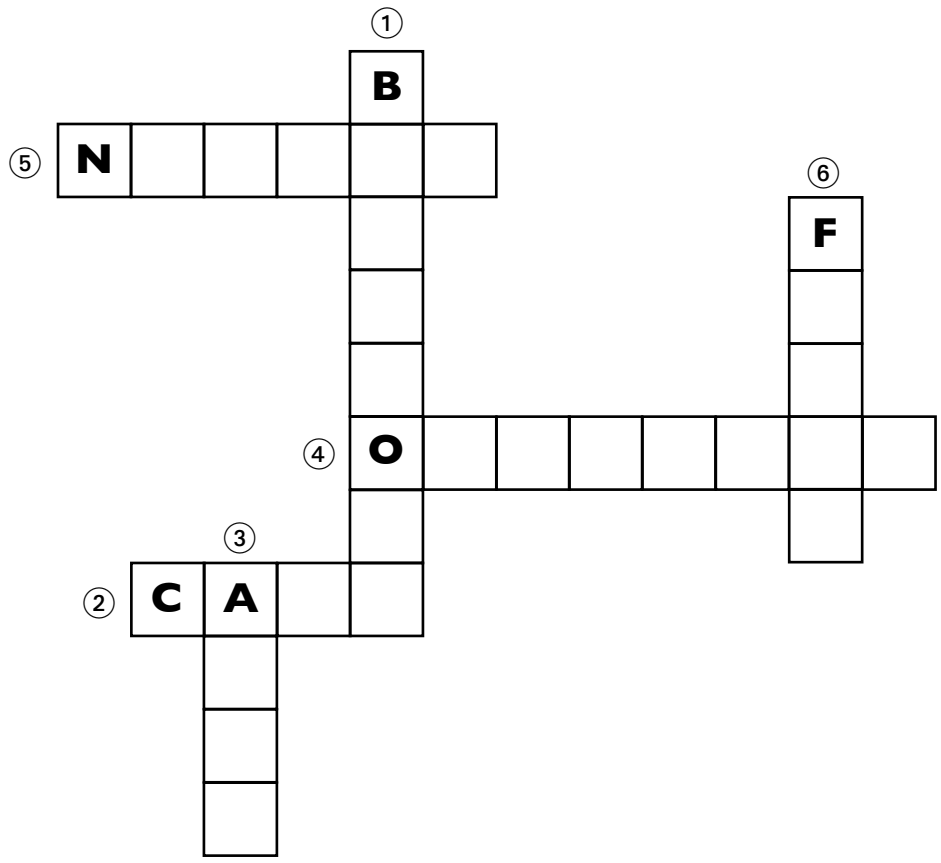
② (across) Worn out hole in a cliff (page 18)

③ (down) When caves cut through a headland (page 18)

④ (across) Famous stack, without wives (2 words) (page 19)

⑤ (across) Tall, thin pillar all alone (page 19)

⑥ (down) Ice-cut arm of the sea (page 21)

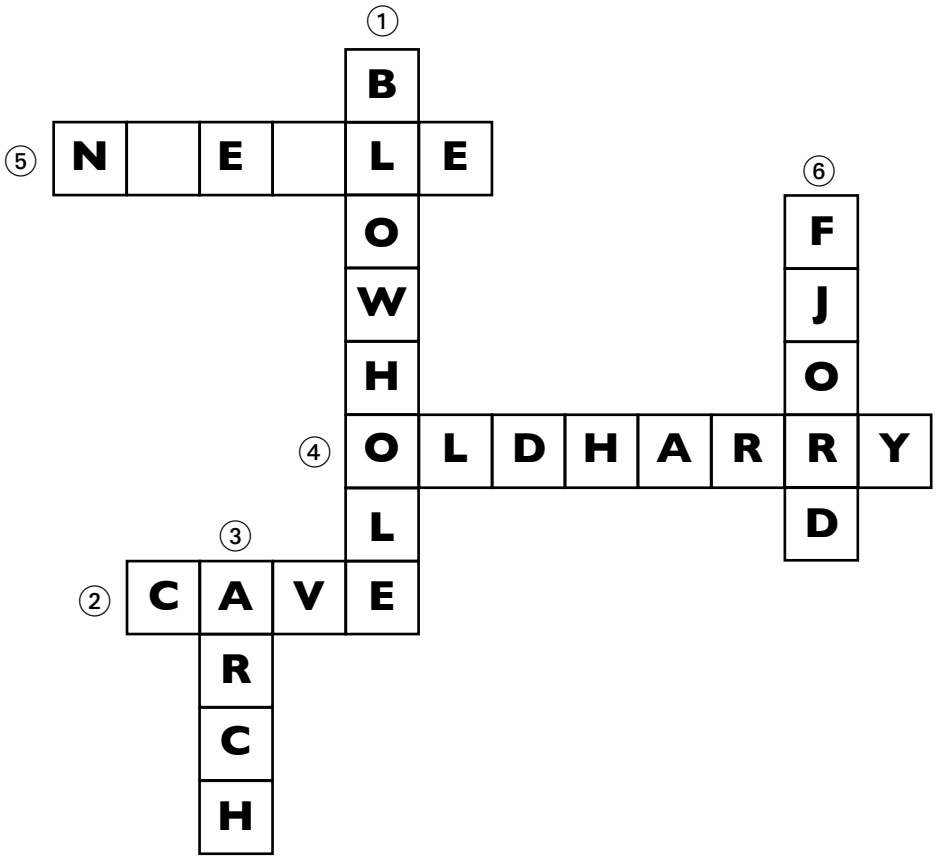


# Crossword Answers

See **pages 18 to 21** of *The Coast Book*

## Answers to crossword 3



Name:..... Form:.....

See **pages 22 to 29** of *The Coast Book*

# Coast crossword 4

① (down) A wave which curves over and breaks (page 22)

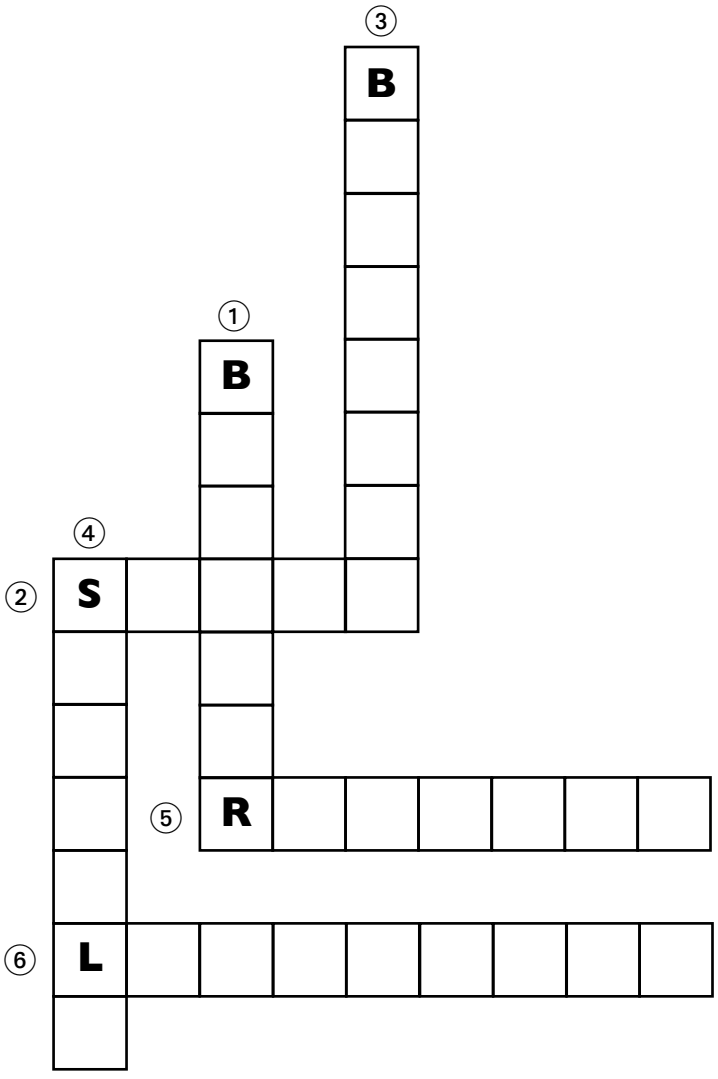
② (across) Foamy water moving up a beach (page 22)

③ (down) Foamy water flowing back down a beach (page 23)

④ (down) Another word for pebble (page 24)

⑤ (across) Wavy ridges on a beach (page 26)

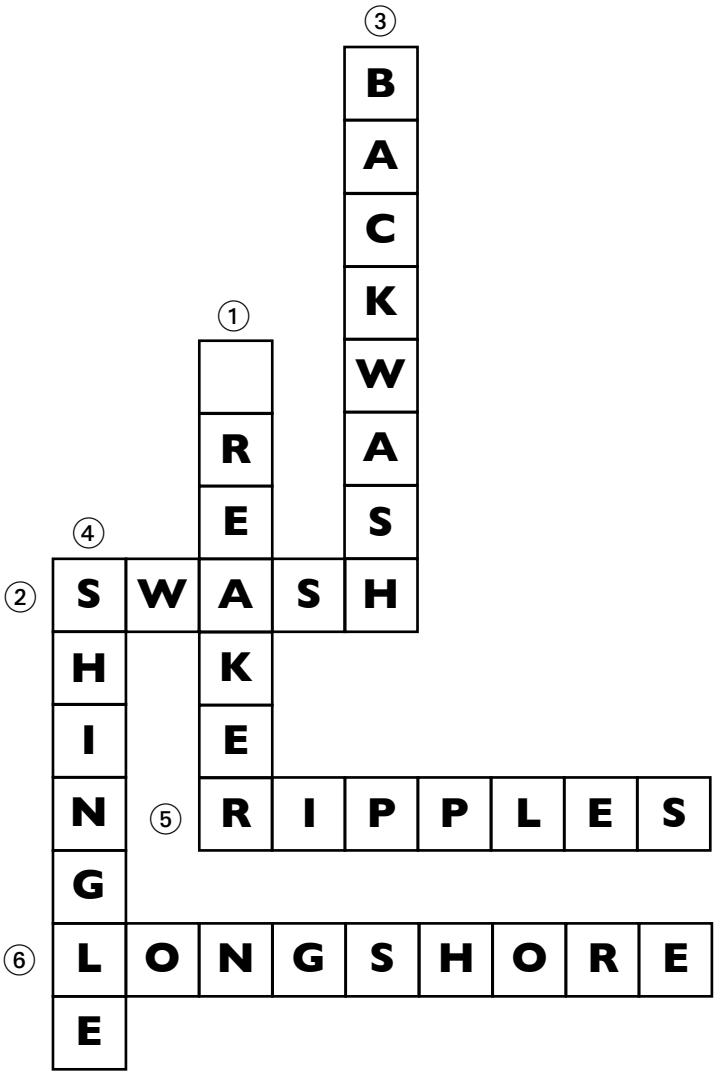
⑥ (across) Sand drifting across a beach (page 29)



# Crossword Answers

See **pages 22 to 29** of *The Coast Book*

## Answers to crossword 4



# Section 6: The Coast Mini-Movies CD explained

The specific purpose of *The Coast Mini-Movies CD* is to enhance the topics introduced in the student book and to allow students to undertake independent research using material presented for their age and ability.

It is possible to use the student book and the CD independently. However, they are designed to reinforce one another.

*The Coast Mini-Movies CD* contains 30 mini-movies shot on location while we were researching for Curriculum Visions books. They are organised into groups: beach, cliff, seaside and waves.

Each movie is supported by field notes, mainly containing a field sketch and written information in the style that students should be able to manage.

The short, focused movies are intended to give you a feel for what it is like at the coast on a geography field trip.

There are also several hundred still pictures, which can be found under the sections 'Field notes' and also under 'Picture research'. These picture research links are found at the top of the navigation panel under each theme. To get to it click on a theme, then on the 'Picture research' button above the word 'Mini-movies'.

These sections share some of the same pictures, but not all.

There is also a spoken dictionary, accessed from the home page. There are links to the Internet for wider research. There is also a project button which provides access to a pdf file of a possible field trip worksheet (included in this *Teacher's Guide* on pages 109–117).

Think of this material as similar to that which you could shoot and compile on your own field trip.

The CD information is browser-based, which means that it can be opened in any browser used to surf the Internet (although it is optimised for Internet Explorer 6 Windows and 5 Mac). The purpose of using a browser application is to make the CD content look and feel just the same as it would on the Internet. The advantage is that you can practise a wide range of computer-based skills at a speed far faster than if you had to download information through an Internet connection. You can network the CD (provided you have bought a licence) so that many students can access the data at the same time.

## Installing the CD

The CD can be used on both Macintosh and Windows-based machines.

Inserting the CD will usually cause it to start up automatically in Windows. However, this depends on the configuration of your machine and the place where the browser application is kept.

If the CD does not automatically start up your browser, then do this:

### Windows

1. Eject the CD and try again. If it still doesn't start then:
2. Open Internet Explorer.
3. Type Control O and browse until you find your CD drive. In it look for the file 'index.html'. Select this and click OK.
4. Save the home screen as a Favorite for quick location in future.

### Mac OS X

#### (Instructions for first time loading)

1. Place the CD into your CD drive.
2. Open Internet Explorer by double-clicking on its icon in the dock.
3. Type  (Command) O and browse until you find the CD.
4. Inside the CD scroll down to 'index.html'. Double click on 'index.html' to launch the CD.

(Important: do not double click directly on index.html – open it from within your browser.)

In all cases, once you have got the disk working, make the home screen of *The Coast Mini-Movies CD* one of your Favorites and then when you load the disk next time you can find *The Coast Mini-Movies CD* directly from this list.


# What to do first

**It is most efficient if you click on the 'Tutorial' button on the home screen before you attempt to look at the contents of the CD. This is a movie in its own right, so give it time to load.**

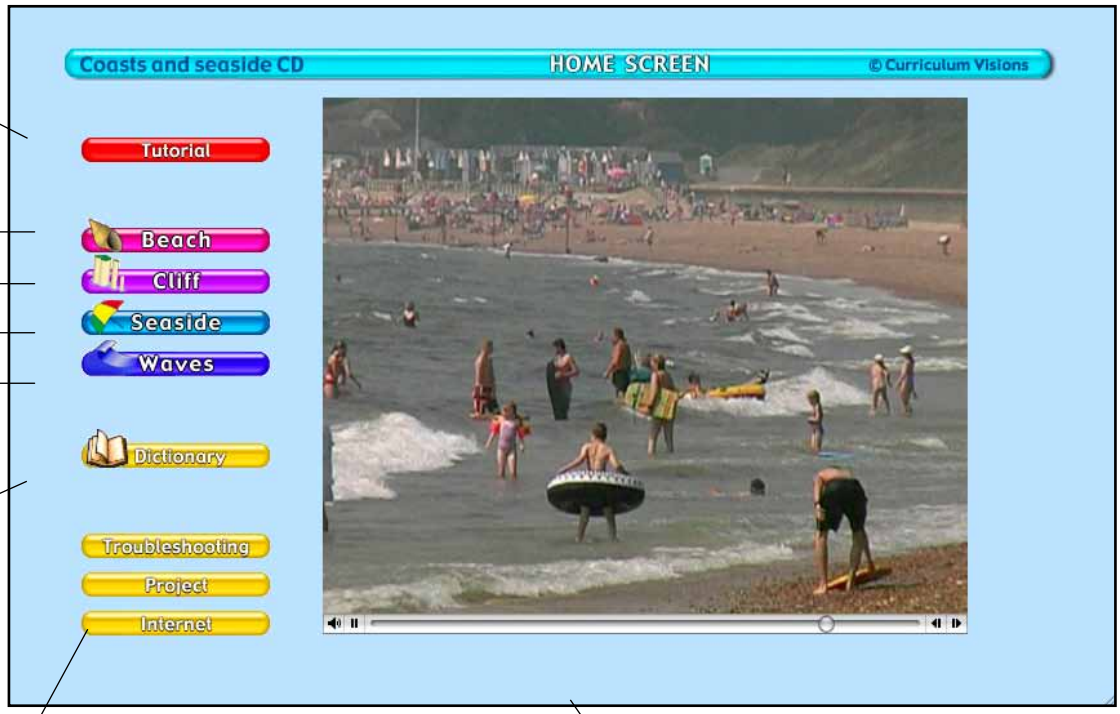
**The 'Tutorial' link will give help about where to find things on the CD. (But it is not intended as a help for how to use a computer).**

# Copying text and images

All of the non-movie elements are unlocked and can therefore be copied for use in other documents. Simply scroll across text or

◀ ***The Coast Mini-Movies CD*** *(the appearance of the CD and its contents may vary from that shown on these pages)*.

**▼ A screen capture of the home screen (the introductory movie will continue to repeat until a button is pressed).**



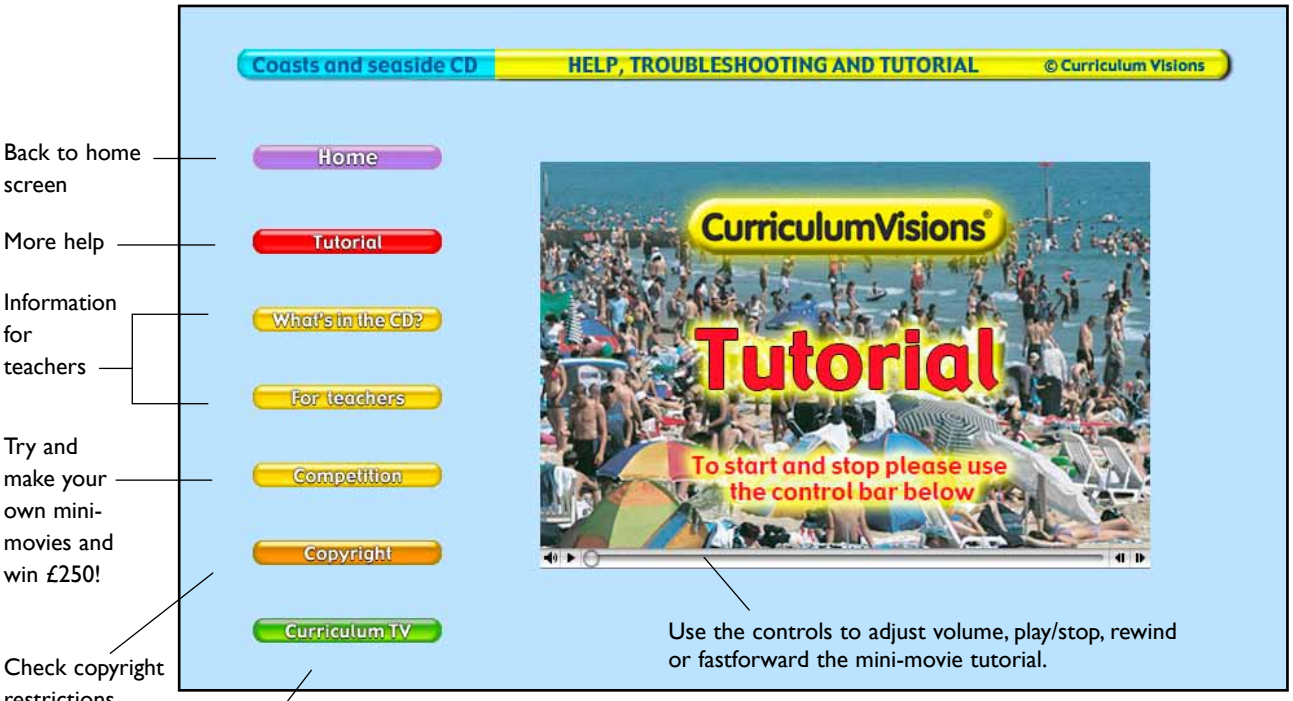

Mini-movie tutorial covering every aspect of the CD

There are four main topics to choose from

Audio visual dictionary

Guidance on preparing and organising your own field trip plus suggested fieldwork worksheets as a PDF file.

Use the controls to adjust volume, play/stop, rewind or fastforward the introductory mini-movie.




**▲ The Coast Mini-Movies CD Tutorial screen.**

(right) click on images to copy them in the method that suits you. Please note that copyright restrictions apply to the use of images.

# The home screen

The home screen should give students an immediate feel for the nature of coasts through the compilation of movie shorts. This movie loops until you select a place to go. The home screen also contains links to take students to the various parts of the data. There are four theme sections, a visual and spoken dictionary, a tutorial, troubleshooting advice, links to the Internet and a project sheet that can be printed.

# Themes

The coast themes are beach, cliff, seaside and waves. They are accessed through the links at the top of the home screen. They each contain information that is organised by sub-topic.

There is more than enough material here to occupy students for many hours and therefore it is essential that you help them to understand what is involved. But the most important thing to realise is that all of this information is presented at the right curriculum level.

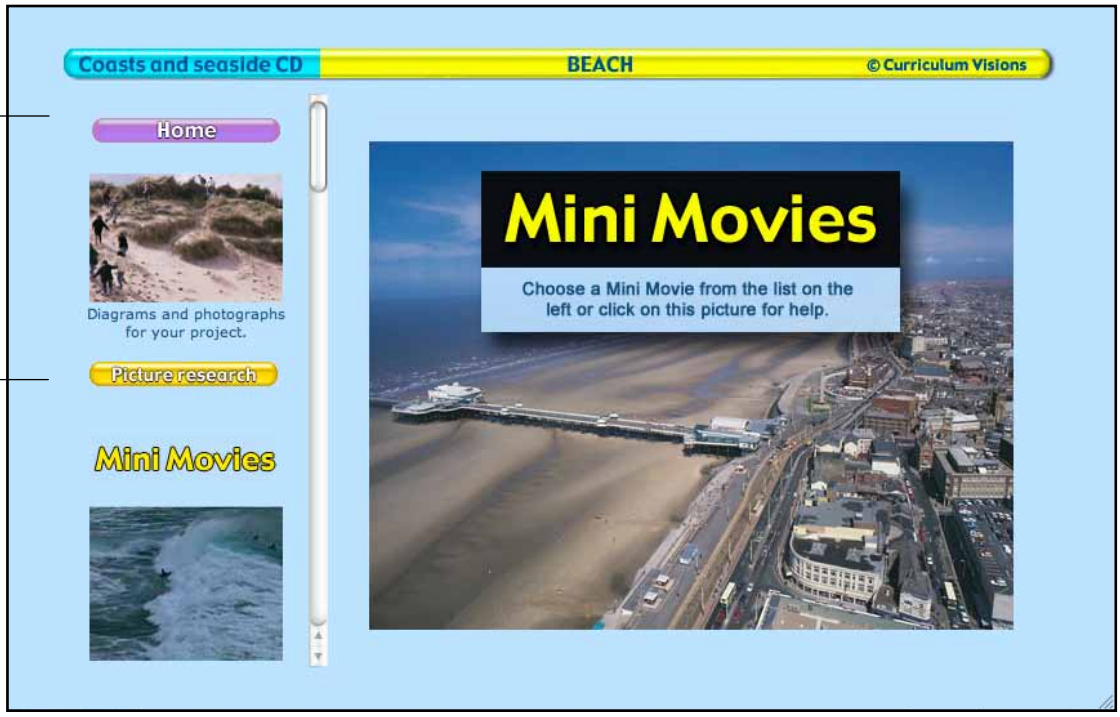
The topics are a systematic way of going through an area of work. The topics are listed on the left-hand side of each screen.

Play the movie either directly on a computer or on a whiteboard and then discuss it. It is essential that the mini-movies are played several times so that students become familiar with their contents. The more times they play something through, the more they will see in the movies.

# Dictionary

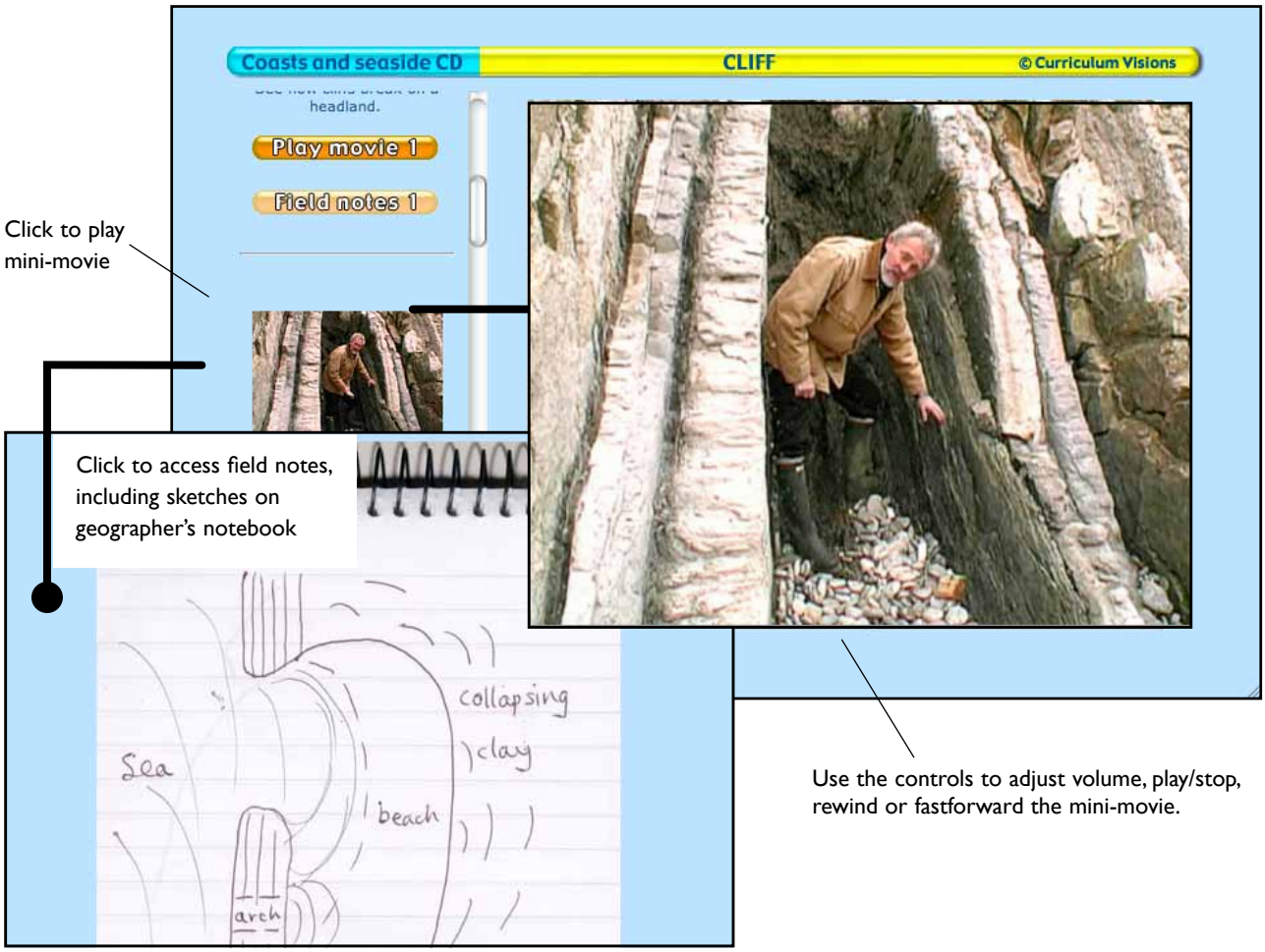
You will find this facility on the home screen. Whenever students want to know about a curriculum word they should click on this button.

**▼ This screen capture shows the main features of each of the four topics.**




Back to home screen

Click here to choose pictures to cut and paste

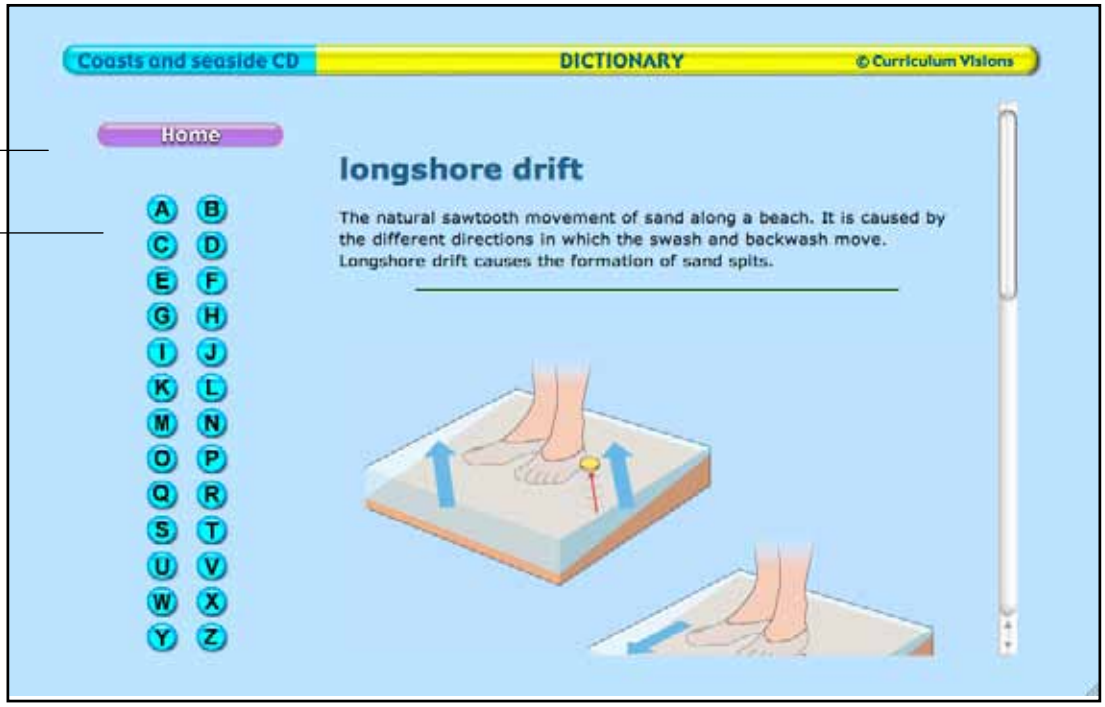



Click to play mini-movie

Click to access field notes, including sketches on geographer's notebook

Use the controls to adjust volume, play/stop, rewind or fastforward the mini-movie.

**▼ This screen capture shows the dictionary with spoken word entries.**




Back to home screen

Click to access alphabetical entries

**▼ This screen capture shows the 'Picture research' button and screen viewing.**


Click here to choose pictures to cut and paste

Scroll through the selection of pictures to copy and paste using the left and right arrows.

The dictionary contains only curriculum words. It is not a global dictionary, but focuses on those words that students will need.

# Project maker

This is meant as a guide for teachers planning a field trip. It contains a pdf file of a suggested plan that could be photocopied and given out to students. It is structured so that students are not left with nothing to do. The worksheets are also included in this *Teacher's Guide* on pages 109–117.

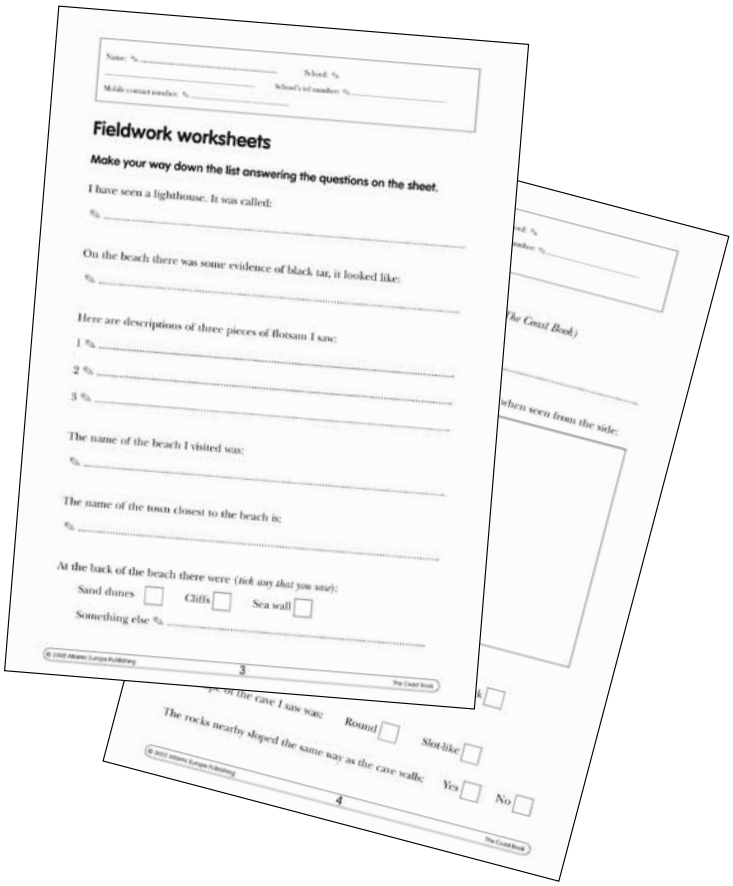
# Picture research

There are many occasions when students want to find an example of a feature. This is made easier by the 'Picture research' button under each theme. Browse this gallery and then copy and paste the pictures as appropriate for the topic being studied or the project being compiled.

# Internet links

Links given on the CD are to a small number of selected web sites which we feel have educational relevance. Some links are to specific sites offering detailed information about particular rivers and places, others are to general sources of fundamental basic information.

You should remind students that web site locations change and, therefore, it cannot be guaranteed that the links will be maintained by the people who run those web sites. Curriculum Visions obviously has no control over those web sites. These links have to be treated, therefore, with a certain amount of pragmatism.




**▲ The 'Project' button gives guidance on preparing and organising your own field trip plus suggested fieldwork worksheets as a PDF file.**

# Section 7: The Coast Picture Gallery CD explained

*The Coast Picture Gallery CD* contains 100 photographs and diagrams. These pictures can be used for any curriculum area such as literacy but the images on this CD have been specially selected for the Coast topic. Many of the pictures are in *The Coast Book* allowing you to integrate your teaching and reinforce key geography concepts.

As with *The Coast Mini-Movies CD*, the information in *The Coast Picture Gallery CD* is browser-based, which means that it can be opened in any browser used to surf the Internet (although it is optimised for Internet Explorer 5 and above).

A browser application makes the CD content look and feel just the same as it would on the Internet. The advantage is that you can practise a wide range of computer-based skills at a speed far faster than if you had to download information through an Internet connection. You can network the CD (provided you have bought a licence) so that many students can access the data at the same time.


The tutorial shows you how the CD can be used.

Click here to go straight into the gallery with the thumbnail view of all 100 pictures.


Clicking on 'Make your own Postcards' shows you how you can make a postcard from any one of the 100 pictures in the gallery!

# Installing the CD

The CD can be used on both Macintosh and Windows-based machines.

Inserting the CD will usually cause it to start up automatically in Windows. However, this depends on the configuration of your machine and the place where the browser application is kept.

If the CD does not automatically start up your browser, then do this:

## Windows

1. Eject the CD and try again. If it still doesn't start then:
2. Open Internet Explorer.
3. Type Control O and browse until you find your CD drive. In it look for the file 'index.html'. Select this and click OK.
4. Save the home screen as a Favorite for quick location in future.

## Mac OS X

## (Instructions for first time loading)

1. Place the CD into your CD drive.
2. Open Internet Explorer by double-clicking on its icon in the dock.
3. Type  (Command) O and browse until you find the CD.
4. Inside the CD scroll down to 'index.html'. Double click on 'index.html' to launch the CD.
   (Important: do not double click directly on index.html – open it from within your browser.)

In all cases, once you have got the disk working, make the home screen of *The Coast Picture Gallery CD* one of your Favorites and then when you load the disk next time you can find *The Coast Picture Gallery CD* directly from this list.

## Copying text and images

All of the elements are unlocked and can therefore be copied for use in other documents. Simply scroll across text or (right) click on images to copy them in the method that suits you.

# The home screen

*(See overleaf, on page 144, for illustrations of the screens described below.)*

The *Coast Picture Gallery CD* home screen shows a gallery of all 100 pictures in thumbnail view.

If you click on any of the pictures in the gallery it will show as an enlarged 'pop-up' view. Clicking on this pop-up picture will take you back to the gallery with the thumbnail view.

Each picture has a simple caption underneath it. At the end of each caption you are given a number of options:

**...tell me more** brings up an extensive caption describing the picture and additional information including cross links to other topics. This description helps children with observation and interpretation skills. It is ideal for literacy tasks.

**...show enlarged view** places the picture in a larger frame.

**...print a postcard** arranges the selected image into a postcard format, complete with humorous 'stamp' and space for the children to write their own message. Just trim to the shape shown and fold the piece of paper over.

You can create a postcard with any one of the 100 pictures in the gallery. Once again an ideal literacy aid.

## Index

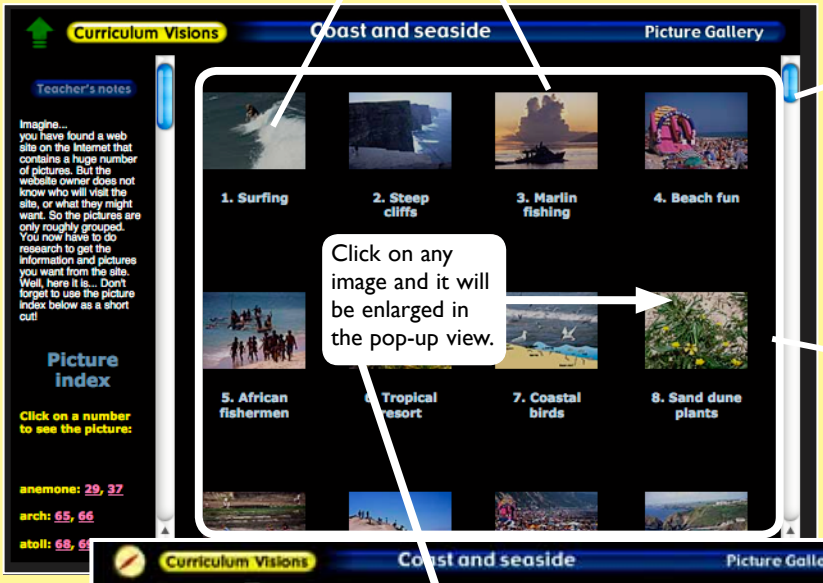
This displays an alphabetical listing of key words on the left panel. If you click on any corresponding image numbers shown after the key word then the relevant picture will be displayed in the pop-up view on the right.

## Help

The help section contains a 'Tutorial' and other assistance for students, teachers and parents.

## ▼ The home screen and related links.

**Home screen**
Click any thumbnail picture in the gallery to see a pop-up view.

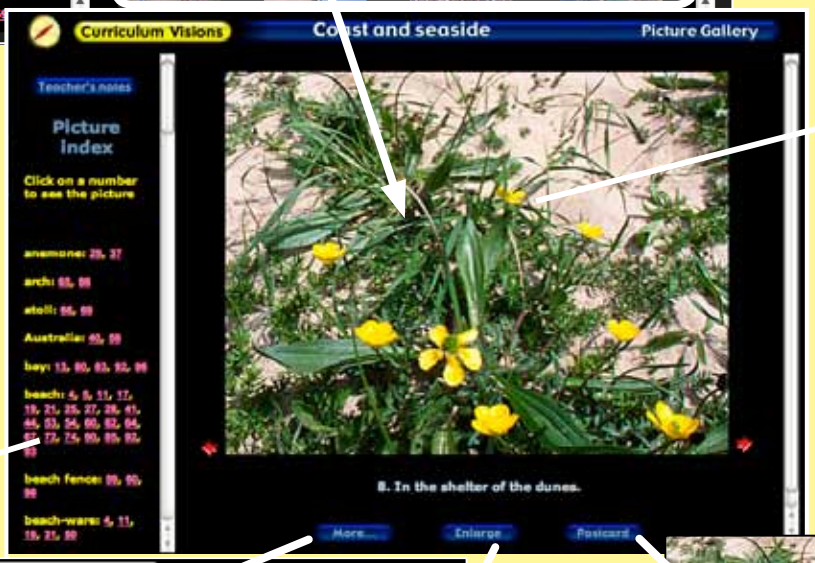



Scroll down the text using the scroll bar.

Click on any image and it will be enlarged in the pop-up view.

Picture captions are extended in the pop-up view.

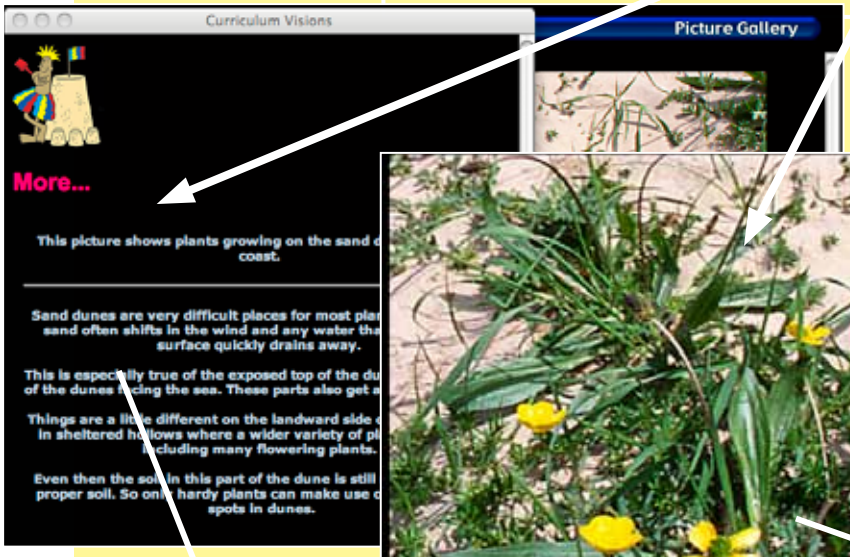
**Index**
Key words with links to related images in the gallery.




Click on the pop-up image to return to the home screen.

**Print a postcard**
Turn any one of the 100 pictures into a postcard and print it for use in literacy or geography tasks!

**Help** includes a tutorial that guides you through the CD.





**More...** provides a description of the image and additional background information.

**Show enlarged view** displays the image in a larger view.