Dawlish Warren

Enquiry 3: How and why is the coastline at Dawlish Warren changing?

Context and Learning Aims

Pupils will be supported in and outside of the classroom to:

- Appreciate why Dawlish Warren has been an attractive location for visitors and tourists for hundreds of years;
- Identify, describe and explain the physical and human features which characterise Dawlish Warren today;
- Understand the physical processes of erosion; transportation and deposition which are occurring along the coastline at Dawlish Warren;
- Understand that the coastline is in a constant state of change and that what we assume as being permanent today may very well have been different in the past and could change again in the future;
- Consider how the process of longshore drift may affect the sand spit at Dawlish Warren in the future and reflect upon what the implications of such change may be for the Exe Estuary;
- Know the causes and effects of the change at Dawlish Warren that occurred in early 2014 and consider what the implications of this might be for the railway in the future.
Learning and teaching activities and curriculum progression

Key Question 3.1: Where is Dawlish Warren?

This initial exercise supports children to identify the location of Dawlish in a global; national; regional and local context. It is worth spending time here discussing with the children how they could use exactly the same process to locate anywhere in the world. This exercise also provides the opportunity to revisit key geographical concepts such as continents; oceans; lines of latitude and longitude and the prime meridian. Resource 3.1 is a PowerPoint presentation which provides the structure required for this exercise. Talk through and discuss each of the slides with the children and then print off the summary sheet Resource 3.2. The children can use this and their discussions when viewing the PowerPoint to complete the summative sheet Resource 3.3. The writing space provided on Resource 3.3 provides an opportunity for children to write an extended answer using appropriate and specialised vocabulary e.g. region; county; continent etc.

Key Question 3.2: What are the main geographical features of Dawlish Warren?

This investigation focuses on the human and physical features which characterise Dawlish Warren and the purpose of the enquiry is to enable children to use a wide range of maps and images to deduce things for themselves. It is worth emphasising to the children that geography is the study of the interaction of such physical and human things – how they are connected and how they affect each other. Divide the children into small groups of three or four. Distribute to the groups the O.S. Map extract in Resource 3.4 and the accompanying key in Resources 3.5 – 3.7. Remind children what the purpose of a map of any kind is (a much smaller representation of reality) and how we need to use a map Key to interpret signs and symbols and a map Scale to convert distance on the map to what it will actually be when we visit a place. Using the map and the key the children can now identify as many human and physical features to be found at Dawlish. Encourage the children to reflect on the definition of ‘physical’ and ‘human’ features. Are some features difficult to place in one category or another? Support the children in their groups to also consider the reasons for the things they have identified at Dawlish actually being there. What evidence is there that Dawlish is a popular place for people to visit? Why would they visit if they had the opportunity? As an individual exercise the children can complete the outline map in Resource 3.8. In the inner box encourage the children to write all of the features they have identified. Then encourage them to draw lines from the labels in the inner box to the outer box where they can write a reason for the feature being in Dawlish e.g. car park – lots of visitors particularly in summer. As an extension activity the children can use the guidance in Resource 3.9 to draft their own travel planner for Dawlish Warren. This is aimed at providing a route for a day tripper coming to Dawlish and an introduction to the main points of interest and activities available.

Key Question 3.3: How can I use Geographical Information Systems (GIS) to understand better what Dawlish Warren is like?

Divide the children into small groups and give each group a copy of the base map in Resource 3.9. Ideally this needs to be printed to A3 size and then placed in the middle of a larger piece of poster paper. If it is printed to A4, then place at the centre of an A3 plain piece of paper. Spend time summarising the work done to date i.e. the main features
of Dawlish Warren identified and discussed – described and explained. Next hand out the aerial photograph images on the sheet in Resource 3.10. Tell the children to cut up the six aerial photographs on the sheet. On the O.S. Map there are six boxes. Each of the satellite photographs goes in each of the six boxes but which is which? Encourage and support discussion amongst the children – this exercise is all about translating signs and symbols on the map to actual features on the photographs – higher order thinking. This is a demanding task as the children need to think conceptually as the aerial images are not to scale. Encourage the use of appropriate and specialised vocabulary throughout e.g. spit; cliff and heath. Once the children are agreed which photograph matches with each box then they can stick each image on the poster paper surrounding the map near the correct box and link it to it with a ruled line. The discussion which follows this is very important. Ask the children to reflect on the exercise. What was the most challenging things they had to do? Make sure each group contributes. Allocate one box on the map to each group and encourage them to describe and explain what they would see if they were standing in the middle? The children can then be challenged to write a geographical summary on the paper for each of the six places in the boxes using subject vocabulary e.g. this site is at the north end of the beach where breakwaters have been built to try and hold the sand back from being washed away through longshore drift. The photographs in Resource 3.11 and 3.12 provide an extension exercise for some children. Here the children have photographs taken on the ground in and around Dawlish Warren to match to both the boxes on the map and the aerial photographs. Finally Resource 3.13 provides an opportunity for all children to write a summative piece about what Dawlish Warren is like. The children can use all of what they have learned from the map, aerial photographs and ground photographs to write a description to gain a ‘sense of place’ for Dawlish Warren. Encourage the children to draw on the vocabulary in the word bank as they draft what they are going to write.

Key Question 3.4: What factors affect the coastline at Dawlish Warren?

Dawlish Warren is an outstanding location for enabling children to identify and understand the physical factors which impact on all coastlines around the world. To begin, work through the PowerPoint presentation in Resource 3.14 which highlights the importance of fetch, geology and weather as three of the most important physical factors which shape our coastline. When explaining fetch take time to show the children the amazing video clip from Billabong Odyssey (Resource 3.15). Print off Resource 3.16 and support the children to complete the map and missing word exercise here to provide a summary of the geology of the coastline at Dawlish Warren. Resource 3.17 enables the children to summarise the main factors affecting the coast at Dawlish Warren, to think about which factor they consider to be most important and to speculate how the shape of the coastline here might change over the next 1000 years!
Key Question 3.5: What are Erosion, Transportation and Deposition?

The PowerPoint in **Resource 3.18** is a highly engaging way for the children to learn about the three key coastal processes of erosion, transportation and deposition. The first two slides show the erosion and retreat of a coastal headland and the four types of erosion operating and this can be consolidated through dance! **Resource 3.19** is an interactive dance video. Introduce the four dance moves on the video and practice them and then get all of the children to stand in a space. Remember *hydraulic action = punching; abrasion = rubbing hands; attrition = fist bumping yourself repeatedly and corrosion = twinkling fingers from high to low down*. Now the children need to watch the film and respond to the screen. The order of the four types of erosion will change so the children need to be alert! After the film the children can complete a story board by drawing an image for every part of the erosion story using **Resource 3.20** and **Resource 3.21**. Read out each paragraph of the story to the children and encourage them to draw a diagram in pencil to illustrate each stage and to add a title and labels using correct subject vocabulary. Before moving on from erosion, go back to the PowerPoint in **Resource 3.18** and show the children the animation of the erosion at Langstone Rock at Dawlish Warren.

The PowerPoint in **Resource 3.18** also provides a simple diagrammatic representation of how longshore drift operates to transport eroded material along the coastline at Dawlish Warren in an easterly direction. An important point to make is that the prevailing wind at Dawlish comes from the west and so as a result the transportation via longshore drift is to the east, but occasionally storm waves approach Dawlish from the east and north east so longshore drift may change direction at those times. The children can now use a copy of **Resource 3.22** to label the diagram with diagonal arrows showing the swash and backwash as waves break along the shore at Dawlish. Once the children have labelled all of the things from the right hand box they can be supported to write an explanation of what is happening. The key objective here is to enable the children to make the link between wind direction and wave direction and the easterly movement of beach materials. After the children have completed their diagram and notes encourage them to identify where the beach appears to be growing; where it appears to be shrinking and what might happen a thousand years into the future if this process continues? As an extension exercise some of the children could create their own storyboard telling the life of a grain of sand through the stages of:

- Eroding from a cliff
- Falling into the sea
- Gets washed up on a beach
- Gets transported along the coastline
- Getting smaller over time
- Finally blown inland by the wind where, if it is trapped by rocks or vegetation, it can become ‘stuck’ and form part of a sand dune.
Key Question 3.5: How does the beach change at Red Rock?

Give out Resource 3.23 to each child and explain what it shows (the width of the beach at Red Rock in intervals along the beach). The children can now be supported to draw a Bar Graph to represent this data i.e. ten sets of data shown in ten bars. What will each axis represent? Make sure the children label both axes correctly and provide a title Bar Graph to show ……. Take time to discuss with the children what their bar graph shows. Is there a pattern to be seen? Does the beach get wider or narrower as you travel to the east or not? Go to the PowerPoint in Resource 3.20 and open Google Earth also. Now distribute copies of Resource 3.24. This graph shows a joined up version of the data and helps to show a pattern. What is it? On Resource 3.25 the bars that the children drew have been located along the beach. On the sheet the children can both describe and give reasons for the pattern shown drawing upon the discussions they had previously. Encourage the children to think into the future. What might happen to the pattern of beach width in the future e.g. if sea levels rise and the area has more frequent destructive storms with northerly and easterly winds? In addition to longshore drift there is also evidence of other coastal processes to be seen at Red Rock as shown in the photographs in Resource 3.26. Ask the children to describe what they see in each of the images. Can they explain, using the correct key terms and vocabulary, how this has happened? Think back to all the work on erosion and the dancing! In addition encourage the children to think about where all of the things shown on the beach in Resource 3.27 may have come from? Will all these things have been local? As a summative piece to this section the children can complete the exercises in Resource 3.28.

Key Question 3.6: How has Dawlish Warren changed over time?

Through this investigation the children spend time considering how and why Dawlish has changed through geological time. This concept of deep time over hundreds of millions of years is a challenging one for younger children especially when there is little documented evidence such as photographs available to illustrate it. Changes may be subtle or slight but children can nevertheless demonstrate their understanding through learning activities such as annotations. The extension exercise to this investigation provides an opportunity for some children to think longer term and consider future change. The most important concept for children to grasp through the enquiry is that the coast at Dawlish Warren is a dynamic system and constantly changing – in the past; now and in the future.

To begin the investigation Resource 3.29 shows eight historic views of Dawlish compared with a modern photograph taken at the same location. Encourage the children to annotate the sheet with:

- A description of the feature shown
- Things that have remained much the same over time
- Things that have changed over time
- Reasons that could possibly explain the changes identified
- A consideration of what this place might have looked like a thousand years past and also a thousand years into the future
To develop this further the children can now work on the pictures in Resource 3.30. For each of the scenes the children need to be supported to draw what they think the place might look like a thousand years into the future and to justify their decision. For example, an arch may collapse or the railway may have to move or have been washed away. Working in pairs the children can compare and discuss their drawings. Encourage whole group discussion and interaction by projecting each of the images one at a time and asking for different ideas about what might happen in each scenario. In particular encourage the children to consider:

• What process or processes caused these changes to occur?
• How are people adapting to the change or may need to adapt in the future?
• How fast are these changes occurring e.g. gradually? Rapidly?

To encourage the children to write a three part answer to what is happening in each picture and why, the PowerPoint presentation in Resource 3.31 provides a writing framework template for each of the views of Dawlish. This is designed to support the children to explain as well as describe what has occurred. In particular they are encouraged to write to the following structure:

• One thing I think will be different or stay the same – something you can see that may or may not change
• This is because – why you think it will change or stay the same
• This will mean that – how the change will affect the place, people, jobs wildlife etc.

As an extension activity some children can be encouraged to study the image in Resource 3.31 and describe how Dawlish Spit has changed over time as well as considering how its shape may change in the future as a result of continuing longshore drift and more regular severe storms occurring as a result of climate change.

**Key Question 3.8: Why was the railway built at Dawlish Warren and how is it protected from coastal processes?**

Tell the children that they are going to see an excerpt of film about the railway at Dawlish (Resource 3.32). The children can be shown the film a number of times to allow them to glean the information they need to say:

• Why Dawlish was such an unusual place to build a railway line?
• Why was the railway built?
• How is it protected from the action of the sea?
• What dangers does it face in the future and why?
Key Question 3.9: How did the coastal storms of 2014 affect the railway line at Dawlish?

The severe storms of January and February 2014 impacted hugely on the coast at Dawlish. The most visible of all the impacts was the effect on the railway line which was undermined by destructive sea waves which caused erosion, slumping and the collapse of a section of the railway. It was closed for seven weeks, effectively cutting off railway travel to west Devon and all of Cornwall. The PowerPoint in Resource 3.32 provides historic images of the railway at Dawlish. Ask the children to consider what each of the pictures has in common? They all show that the challenge of the sea to the railway line is not new. On several occasions in the past there has been a collapse of the embankment on which the railway runs necessitating repairs to the wall. So, the collapse of 2014 was not a total surprise but how will the threat of the sea increase in the future through rising sea levels and more frequent storms brought about through climate change? The photographs in Resource 3.33 are designed to stimulate thinking amongst the children of the impact of the 2014 storms in Dawlish. In particular ask the children to identify causes and effects. Who do they feel would have suffered most from the damage? Encourage them to think widely about for example, home owners; local shops and businesses; visitors and holiday makers; wildlife etc. Discuss the ideas of the children and on the whiteboard categorise them under the headings of social; economic and environmental effects. The template in Resource 3.34 provides a framework for the children to record their ideas with examples provided to support them in Resource 3.35. Additional film footage of the changes caused at Dawlish as a result of the storms can be found in Resource 3.36. These can be shown intermittently throughout the investigation. As a summative piece of work for this enquiry the children can produce a newspaper report using the template in Resource 3.37 to explain to readers why Dawlish Warren is so vulnerable to coastal processes and what the causes and effects of the storm events were in 2014. The children may want to consider here what some of the long term solutions might be to the problems caused to the railway by erosion along the coast at Dawlish. May, for example, a new route inland have to be found eventually for the railway? Some of these ideas are contained in the PowerPoint in Resource 3.38.
Sample Resources from Enquiry 3. The complete set of resources supporting learning in this enquiry are available on the accompanying DVD and online at www.lcco.eu

Resource 3.9

What is Dawlish Warren like?

Ordnance survey maps are great for showing us in detail what a place is like. They use symbols and words and are always drawn with north at the top.

The coloured boxes identify 6 sites. Try and link your satellite images and photos to each site.

Credit: Andy Schindler www.outdoorlearningforschools.co.uk and www.google.com/earth/
What is Dawlish Warren like?

Using the Ordnance Survey map provided you and your group must try and work out where these satellite images are of. Cut them out and place them around your map. Be ready to say why you think they go there!

Credit: Andy Schindler www.outdoorlearningforschools.co.uk and www.google.com/earth
Evidence of coastal processes

In order to investigate the processes happening at Dawlish Warren measurements were taken at intervals along Red Rock Beach.

<table>
<thead>
<tr>
<th>Site No.</th>
<th>Distance NE</th>
<th>Beach Width</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>100</td>
<td>9.3</td>
</tr>
<tr>
<td>2</td>
<td>200</td>
<td>13.0</td>
</tr>
<tr>
<td>3</td>
<td>300</td>
<td>16.9</td>
</tr>
<tr>
<td>4</td>
<td>400</td>
<td>18.2</td>
</tr>
<tr>
<td>5</td>
<td>500</td>
<td>22.7</td>
</tr>
<tr>
<td>6</td>
<td>600</td>
<td>28.6</td>
</tr>
<tr>
<td>7</td>
<td>700</td>
<td>30.0</td>
</tr>
<tr>
<td>8</td>
<td>800</td>
<td>30.9</td>
</tr>
<tr>
<td>9</td>
<td>900</td>
<td>42.2</td>
</tr>
<tr>
<td>10</td>
<td>1000</td>
<td>63.1</td>
</tr>
</tbody>
</table>

As well as beach measurements, photos and sketches were used to show evidence of erosion, transportation and deposition.

The beach widths have been graphed on the next slide. What happens to the size of the beach along the coastline? Will it stay the same or will it change? Why?

Credit: Andy Schindler www.outdoorlearningforschools.co.uk and www.google.com/earth/
Evidence of coastal processes

Bar chart to show the beach width at Red Rock at 100m intervals

1. How does the beach change along the coast? (Remember to use measurements to help describe the pattern)

2. Give reasons for the pattern.

Key Terms: prevailing winds, energy, longshore drift, transportation, waves

Credit: Andy Schindler www.outdoorlearningforschools.co.uk and www.google.com/earth/