

Explanatory notes

The actions of the sea and the weather are the major causes of changes to the coastal landscape of the South West of England, leading to both erosion, where material is worn away, and accretion, where it is deposited.

A major cause of coastal erosion is the power of waves. When a wave hits a cliff face or sea defence, any weaknesses can be gradually expanded, destabilising the structure. Waves also carry sand and pebbles and these can wear away cliffs and man-made defences. The stormier the weather, the bigger the effects. In calmer weather, the sea can deposit sediment, causing beaches to grow.

Beaches themselves are a strong defence against erosion: put simply the further a wave has to travel up a beach the weaker it becomes.

The South West Coastal Monitoring (SWCM), which was founded in 2006 to provide a standard, repeatable and cost effective method of monitoring the coastal environment in the region.

The programme operates from Portland Bay in West Dorset to Beachley Point in Gloucestershire on behalf of the region's maritime local authorities and coastal groups, as well as the Environment Agency and Defra, and is managed by Teignbridge District Council (TDC). Dawlish Warren is a sand spit which extends across the mouth of the River Exe. Over time the spit has become more established creating dune habitats and allowing for the development of different amenities. As well as providing land for development Dawlish Warren also provides shelter for towns on the estuary and safe mooring space for boats. By comparing historic and modern aerial imagery it can be seen that the natural input of material has allowed the spit to grow considerably over the last 60 years. However the building of sea defences to protect other areas of the coast have limited the availability of material. Analysis of data collected over the last 17 years by SWCM shows the areas of the spit which are eroding and accreting.

In 2017, the Environment Agency and TDC worked together on a £12 million scheme to reduce the risk of flooding to nearly 2,900 properties around the Rive Exe. Work included in the scheme ranged from installing a new 'sandbag' defence under the dunes at the narrowest point of the Warren (Figure 1), removing gabions, replacing, and modifying timber groynes and near-shore dredging operations to recharge the amenity beach.

The current situation facing local authorities is how to protect the already fragile and eroding areas without creating knock on effects for adjacent stretches of coast. Coupled to this is the duty to consider all of the needs of the local residents, stake holders flora and fauna who depend upon the spit.

The SWCM's data is freely available
southwest.coastalmonitoring.org.

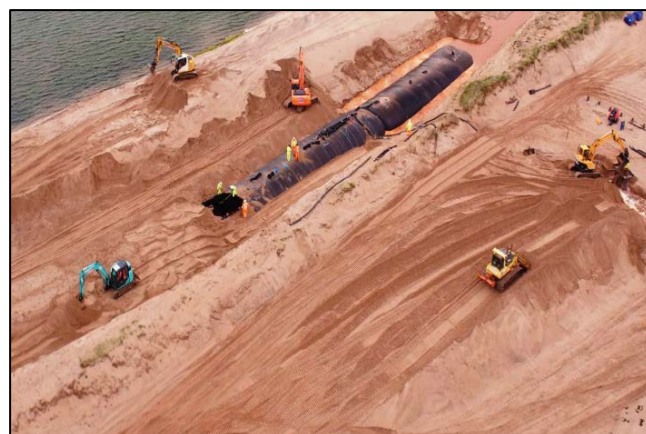


Figure 1 The GeoTube defence, being buried beneath the Warren.



Figure 2 Aerial photography of Dawlish Warren and its location within the southwest.

1 Dawlish Warren (Figure 2) is a geographical spit feature that protrudes into the mouth of the River Exe on the south coast of Devon. Located on an exposed piece of coast and at the mouth of a large river there are a lot of processes which influence the size and shape of the spit. The wave rose (Figure 3) shows the direction that waves come from at Dawlish, do you know how this might help the building of the spit?

2 Because Dawlish Warren is in such a dynamic area it is constantly changing size and shape (Figure 4). The image on the next page (Figure 5) was taken in 1947, how has the spit changed since then? Does this confirm your thoughts on the building processes?

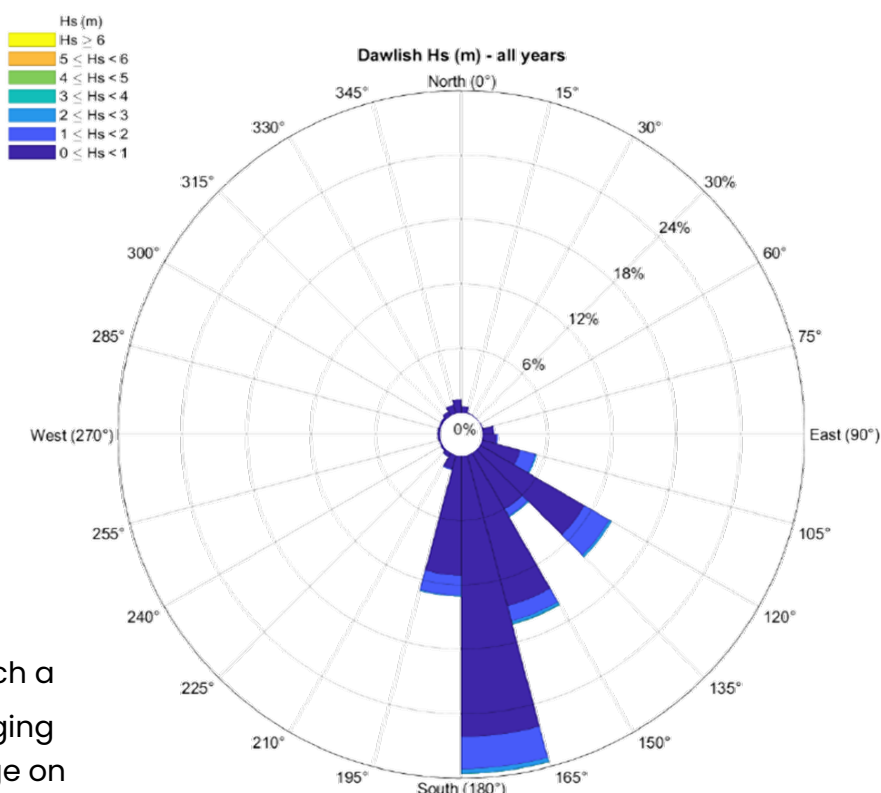


Figure 3 Wave rose of Dawlish Directional Wave Rider buoy, displaying the significant wave height (Hs) between 2010 and 2023.

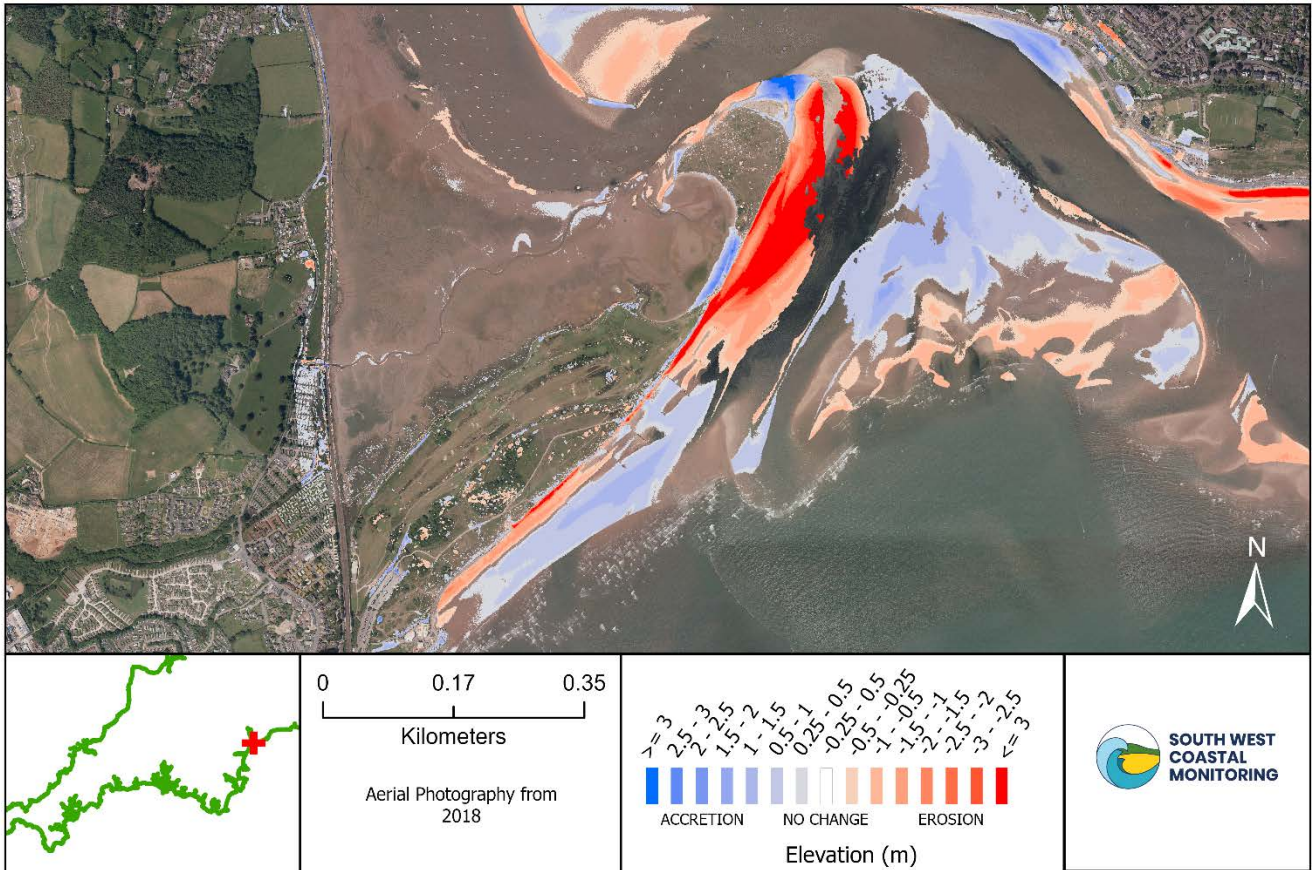


Figure 4 A difference model of Dawlish Warren, displaying the elevation change (m) between 2007 and 2023.

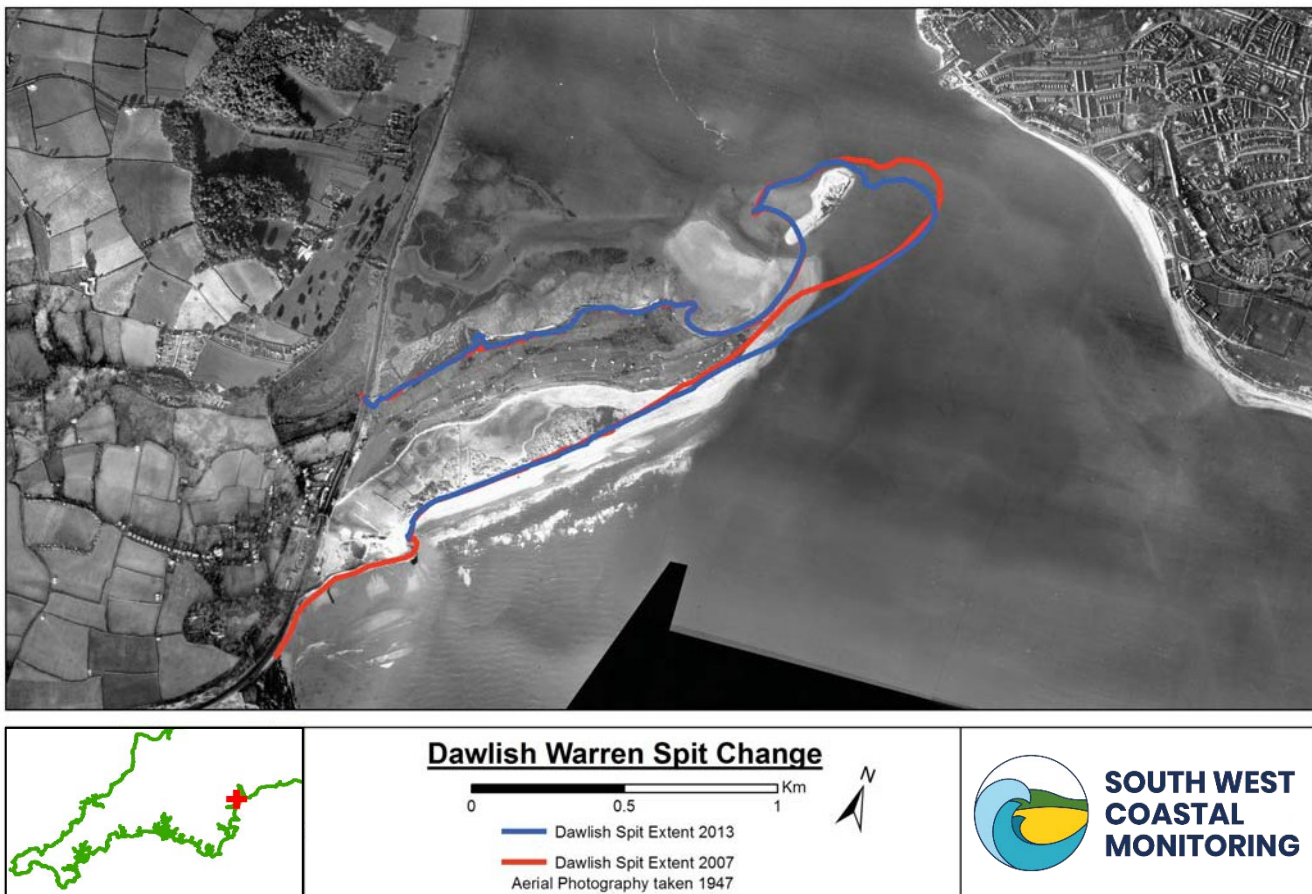


Figure 5 Historical aerial imagery of Dawlish Warren from 1947, overlaid with two spit extents from 2007 (red) and 2013 (blue).

3 Because lots of people use the spit and surrounding coastline, attempts have been made to protect buildings using sea defences such as groynes, rock armour, gabions and breakwaters. Do you think installing these sea defences will have only a positive effect on the coast or could they cause more damage?

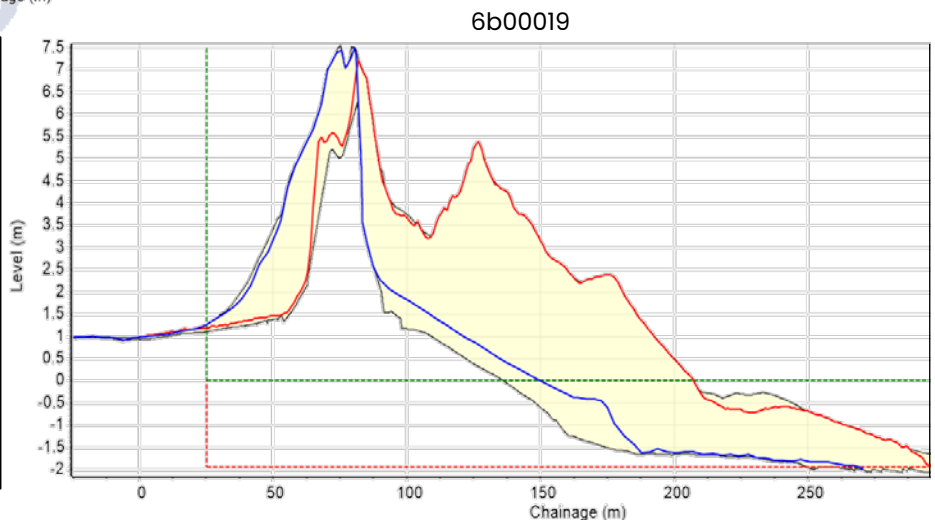
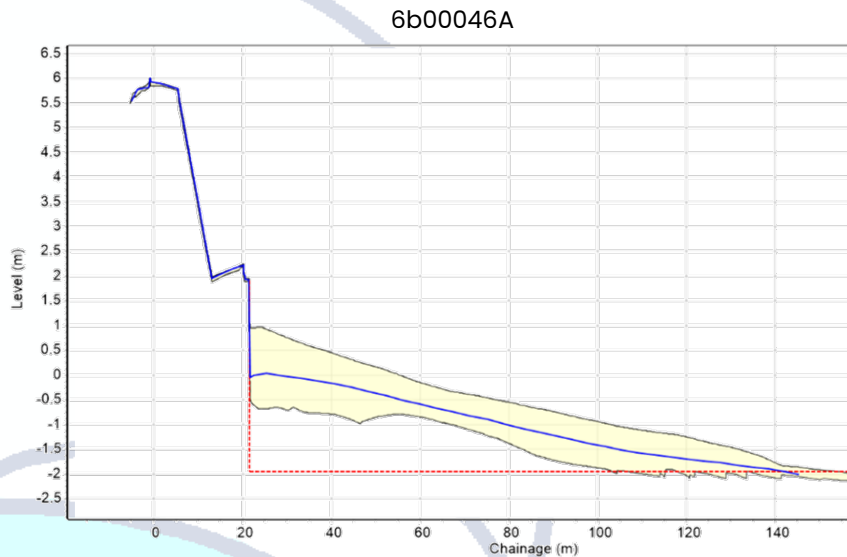


Figure 6 Side profiles of (top) profile 6b00046A and (bottom) profile 6b00019, displaying the baseline profile from 2007 (red), the most recent spring survey in 2024 (blue), and the range of elevation between the epochs, both with accompanying photographic imagery from 2024.

4 Look at the two profiles of beach shape above (Figure 6). The top profile is situated in front of a seawall. In what way has the beach changed shape and how might this effect the seawall? The bottom profile is in front of a dune, where do you think the material may have gone?



Figure 7 The location of profiles 6b00019 and 6b00042A.

5 What will happen if the spit keeps getting thinner? Who will be affected?

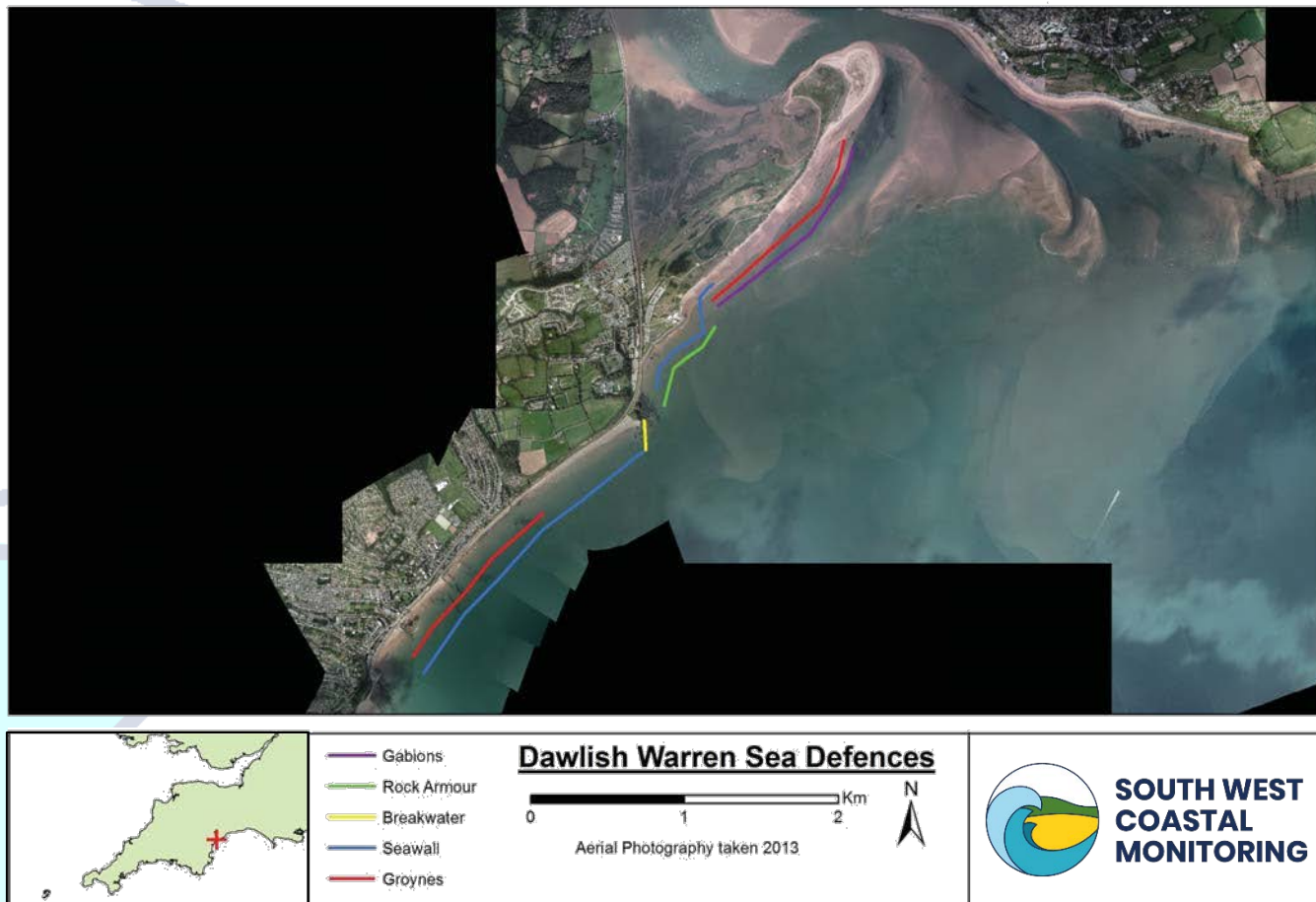


Figure 8 Aerial imagery of Dawlish Warren, displaying the different types of sea defence *in situ*.

6 Given all the evidence, should attempts be made to keep the spit in its current shape or should natural processes be allowed to take over?