



# SEA LEVEL RISE



This science pack has been created by the Marine Alliance for Science and Technology (MASTS). MASTS is an organisation that enhances the excellence of marine research in Scotland across 17 institutes and 700+ members. With such a large number of scientists working at the forefront of marine science, MASTS recognises the importance of communicating what we learn to the public.

People Ocean Planet (POP) is an initiative within MASTS, helping to drive positive changes across society for the ocean by making best use of our scientific knowledge.

To deliver this information we have worked with experts from MASTS Research forums. There are 12 of these forums in MASTS, creating a network of experts who meet to discuss, direct and support the research in their field. In this section of the pack you will hear from Dani Whitlock the representative of the Biogeochemistry forum.

You can learn more about MASTS, People Ocean Planet and the Biogeochemistry Forum in the QR links to the left.



MASTS



POP



Biogeochemistry  
Forum

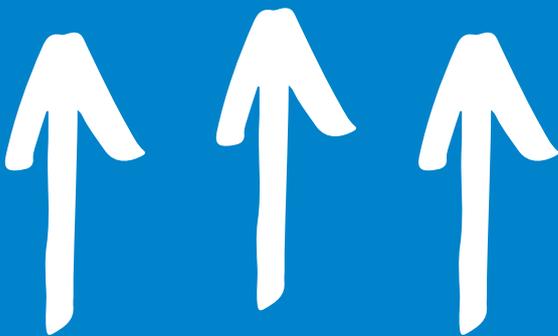
## Curriculum Links

### Age 11-14

Biology - Relationships in an Ecosystem  
Human and Physical Geography - Physical and  
Human Geography  
- Expressive Arts



If this logo is in the bottom right hand of a page, there is a more printer-friendly version of this page available in the 'to print document' on our website.





# DR DANI WHITLOCK

PROJECT OFFICER  
AT FIDRA

## ABOUT DANI

### HER JOURNEY INTO STEM

At a young age I was definitely not academic and struggled. In my wildest dreams I would have never have imagined I would go on to become a scientist. I had drive, determination and a passion for the environment so I just kept going, questioning the world we live in and trying to use my knowledge to improve the world we live in.

### HER JOB

Project Officer at Fidra, an environmental charity working to reduce plastic and chemical pollution in the ocean.

### HER HOBBIES

I love being outside, whether that's on a mudflat or up a mountain. I have a very energetic border collie puppy called Ollie and he likes to explore just as much as me. I also love to ski. If I'm not outdoors I'm in my garage doing DIY.

### THE QUESTION DANI WANTS TO ANSWER IS...

Have you ever considered how important soil is? Peatlands are a very special ecosystem that helps capture a lot carbon - but peatlands are threatened for reasons such as, using peat as compost in gardens.

### DANI INSPIRES YOU TO THINK ABOUT...

How you can implement positive eco-friendly changes into your family's lives?

IT'S TIME TO EXPLORE SEA LEVEL  
RISE WITH DANI - LETS GO!

It is an important part of a scientist's job to ask questions. Asking questions is the first step to learn more about a topic. We can then go and find the answers by reading more information on the topic, or if there are no answers we can do our own experiments and research to find out.

## ACTIVITY 1

After listening to Dani's talk, do you have any questions? Write them down in the space below.

TIP: you can use a question frame for your experiment to help you think of questions!



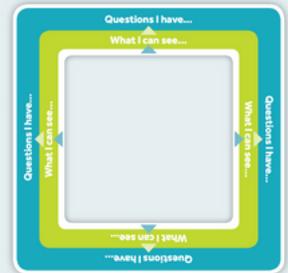
### Question Frame

#### What you need?

A pair of scissors, a pencil, an object that you're curious about, sticky labels (optional).

#### How does it work?

- 1 Make a frame out of an old cardboard box or use the printable. Be careful when cutting out the window in the centre.
- 2 Place the frame over an object or image, so that it appears in the window.
- 3 Observe what it looks like and describe what you can see.
- 4 Now, think about questions you have and jot them on a sticky note around the side of the frames.
- 5 Select the question(s) you wish to share.



Print off the frame on the next page for cutting out!



[www.greatscienceshare.org](http://www.greatscienceshare.org)

Share your questions on Twitter using @GreatSciShare | #GreatSciShare

Space to write your questions:

Download the question frame and other question makers using this QR code!



# COASTAL HABITATS

IN THIS NEXT SECTION DANI HAS ANSWERED SOME QUESTIONS ON THIS TOPIC

# WHAT?

WHAT IS A HABITAT?

The home or environment of an animal or plant where all the conditions for the survival of that organism are found.



## ACTIVITY 2: WORD SEARCH

Can you find all the coastal habitats within this word search? There are EIGHT habitats and TWO secret words!

S	V	F	X	D	V	H	O	I	A	B	B	H	R	F	K	T	J	S	P	M	I	V
A	M	H	O	N	B	O	C	D	L	W	T	H	G	B	Y	M	F	H	M	D	J	S
L	F	G	E	Z	K	J	A	L	N	E	G	I	O	X	O	R	V	I	M	T	T	A
T	H	T	G	I	O	R	W	V	Y	I	B	N	S	W	I	C	V	N	N	P	J	N
M	R	A	W	W	J	N	Z	X	H	E	M	P	M	C	R	G	K	G	E	C	X	D
A	O	X	O	K	E	D	H	T	K	M	W	K	Q	J	K	T	M	L	X	R	P	B
R	C	T	U	Q	Y	W	M	U	D	F	L	A	T	S	M	D	A	E	N	R	X	E
S	K	W	A	C	E	G	N	A	H	C	E	T	A	M	I	L	C	B	Z	R	J	A
H	Y	A	Q	I	H	D	J	D	Q	P	D	B	N	D	R	N	T	E	N	C	B	C
E	S	C	L	I	F	F	S	U	J	I	O	B	F	B	K	O	Q	A	H	D	B	H
S	H	W	I	E	S	R	O	H	A	E	S	R	K	S	N	L	I	C	G	V	R	E
L	O	O	A	S	A	N	D	D	U	N	E	S	Y	D	Q	G	S	H	G	V	H	S
C	R	Z	R	G	L	H	Q	B	D	Y	S	E	C	N	W	I	P	E	A	X	M	X
X	E	D	G	Q	F	A	S	R	J	D	P	Y	O	S	V	N	M	S	C	U	E	B
S	S	Y	R	D	K	T	I	A	Z	E	R	X	G	Y	O	B	X	L	W	I	R	O
L	U	Z	S	E	A	G	R	A	S	S	M	E	A	D	O	W	S	N	L	B	Q	C

The secret words are

.....

and

.....



# WHAT?

## WHAT THREATS DO COASTAL ECOSYSTEMS FACE DUE TO SEA LEVEL RISE ?

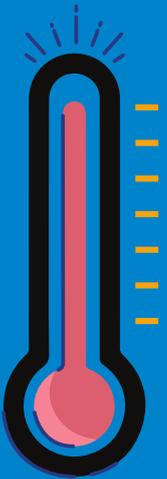


Climate change is causing sea level rise, threatening coastal communities, infrastructure and coastal habitats. The coast is a vital component of climate systems. The increased sea temperature can also increase the destructive potential of storms and have impacts on coastal plants and animals.

Climate change is the change in weather patterns which are caused by human activities. Including burning fossil fuels through energy consumption (e.g. travelling) removing forests for urbanisation and farming practices.

# HOW?

## HOW MUCH HAS THE SEA LEVEL RISEN?



Since 1993, seas around the world have been rising at an average rate of 3.3 millimetres per year.

# WHAT?

## WHAT AREAS WILL BE MOST AFFECTED BY SEA LEVEL RISE?

Coastal areas have been subject to the most intense change from human activities. Coastal areas are highly populated; in Europe, 70 million people live within 1km of the coast, almost half of the European Union population lives less than 50km from the sea. People live and visit the coast because coastal habitats provide lots of benefits to us and are relied upon for trade.



# WHY?

## WHY DO WE WANT TO PROTECT COASTAL HABITATS?



All coastal habitats could be affected negatively from sea level rise.

Coastal habitats are really important providing lots of positive benefits to humans and the greater environment.

There are four main categories explaining how we benefit from coastal habitats:



### PROVISIONING SERVICES

A provisioning service is a service that can be directly taken from nature. Things that humans can make use of.

- Fisheries
- Building materials

For example, fishfingers are made from fish. Commercially important fish communities may rely on a seagrass meadow to feed and grow.



### REGULATING SERVICES

A regulating service is a process that helps maintain conditions favourable for life.

This includes:

- The storage of carbon in sediments
- Coastal habitats act as a barrier to protect coastal communities from erosion caused by storms and waves



### CULTURAL SERVICES

A cultural service is a non-material benefit humans gain from nature. These include recreational enjoyment, as well as physical and mental health benefits.

In Europe, the seaside is the most popular holiday destination which is important for people's livelihoods.



### SUPPORTING SERVICES

A supporting service is different from all other services, because their impacts are indirect to humans and they allow earth to sustain basic life.

These include nutrient cycling, oxygen production and soil formation.



# ACTIVITY 3: NAME THE SERVICE

Identify which service each of the items below belongs to.  
Colour all the post-stick notes with the matching colour

**PROVISIONING  
SERVICES = BLUE**

**REGULATING  
SERVICES = GREEN**

**CULTURAL  
SERVICES =  
YELLOW**

**SUPPORTING  
SERVICES = RED**

Plant material can be used to make baskets

Snorkelling

Plant material used for fuel, such as wood

Production of food

Plant and rock structure providing habitat, refuge and nursery for species

Rockpooling

Filtering pollution

Water-skiing

Sediment stability - how likely soil is to be washed away by the sea.

Oxygen production

Soil formation from soils and rocks deposited into habitats

Wave and current dampening

Seed production and dispersal

Carbon accumulation - how much carbon is removed from the atmosphere and stored in a habitat

Nutrient cycling - a process where nutrients used to help organisms grow, can be used again by other organisms



# ACTIVITY 4: HELPING TO PROTECT A HABITAT



An important part of protecting a marine habitat is being able to raise awareness of potential issues and sharing the science behind them.

For this task, you are going to pick a habitat to share information about.

We have provided some cards with information on about different habitats. You can use one of these habitats or can pick another one. We encourage you to also go and research more about your chosen habitat - if you want!

We have also provided some of thoughts on how these habitats may be threatened (Activity Sheet 4A), and what actions we can take to protect them (Activity Sheet 4B). But we have left many spaces blank - its up to you to research and fill these in with answers relevant to your habitat.

## To Do List

- Read the habitat cards
- Pick a habitat to research and share about
- Research the threats to the habitat from climate change
- Research the ways to protect the habitat from climate change
- Share what you have learnt about the habitat

Once you have done your research and its time to share what you have learnt.

This can be in any way! Maybe you want to write a story or poem. Maybe you want to write a song, perform a dance or draw a picture. Could you make a poster or a sign? A book or leaflet? Write a serious speech or put a comic twist on the talk to grab peoples attention. It's up to you!

You may not immediately think these skills relate to being a scientist, but as scientists we have to communicate what we learn and research all the time. We give talks at conferences, present posters of scientific information and sometimes even speak on the news or television. So it's important to practice how we share our science!

# SEAGRASS MEADOWS



A seagrass meadow looks just like a meadow of grass on land, but the grasses can survive in sea water! Seagrass might sound uninteresting, but it is incredibly important. There are 72 different types of seagrass and they are found on every continent in the world, except the Antarctica.

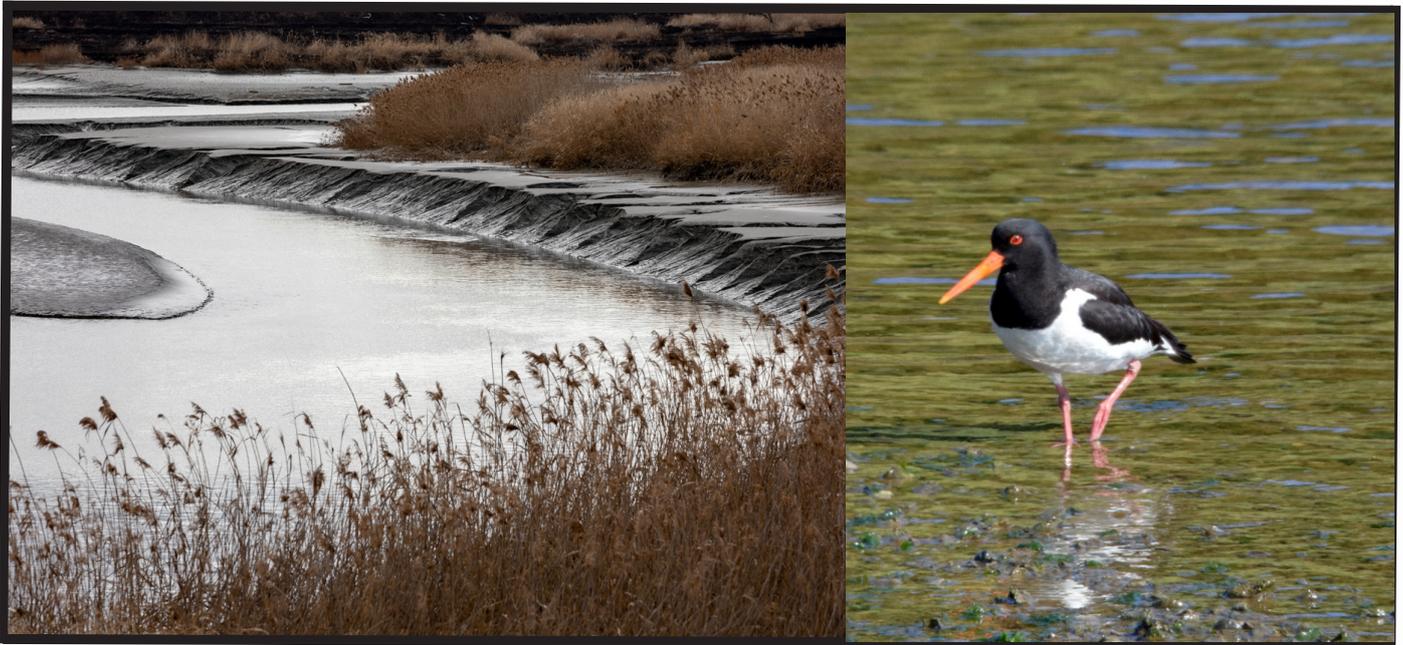
Seagrasses provide lots of services to humans and the environment.

Including:

- They provide a home and shelter for a diverse community of fishes and other sea life including seahorses, lobsters and crabs.
- They also provide food for sea turtles in some areas of the world.
- One type of seagrass found in the Mediterranean is very good at storing carbon in the sediment it grows in. The type of seagrass is called *Posidonia oceanica* and unlike any other seagrass it has a woody structure, which makes it look more like a tree than grass living under the sea.



# MUDFLATS



Mudflats are also known as tidal flats, and is an area where sediment accumulates due to the river and tides. Even though these habitats are 'muddy' and usually empty of any plant life. Very stable mudflats are often gradually colonised by plants including seagrasses and marsh plants.

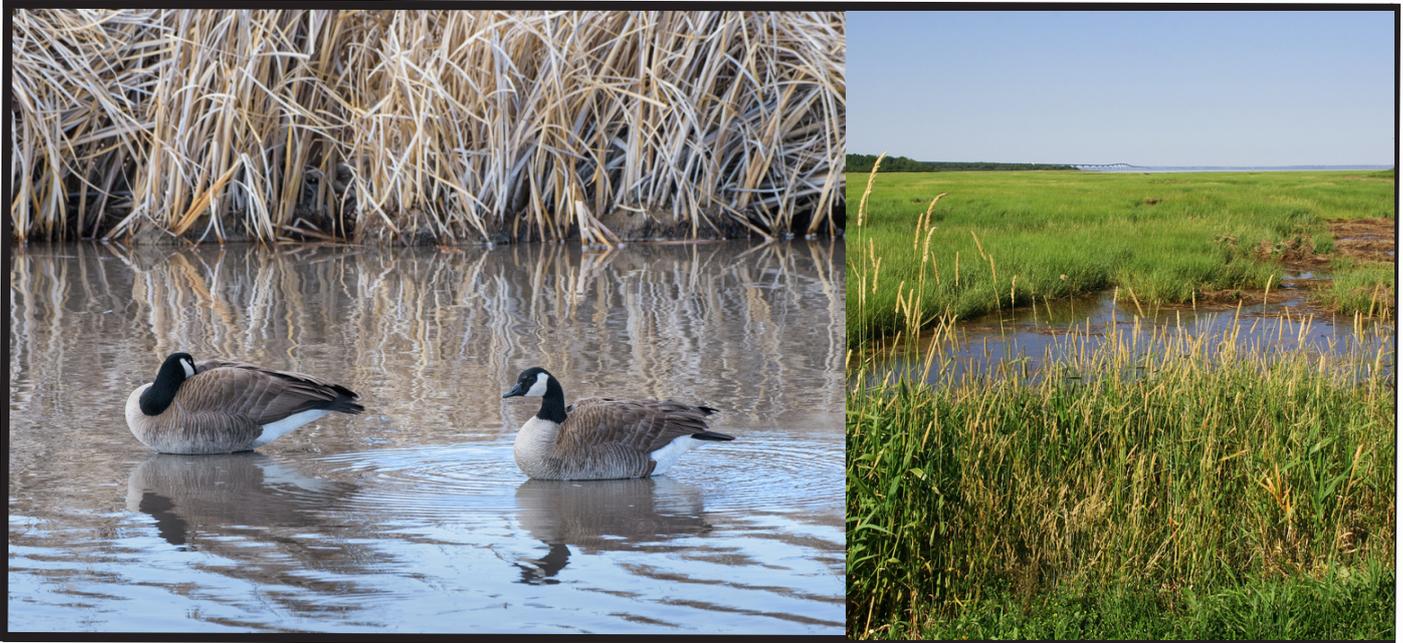
Mudflats are important because they help to protect inland areas from erosion by acting as a barrier.

Their empty appearance is deceiving as lots of sea snails and animals live here, such as molluscs. Which makes them a really important habitat for migratory and sea birds who eat these organisms.

In Northwest European countries including Germany and the Netherlands mudflat hiking can be a popular activity!



# SALTMARSHES

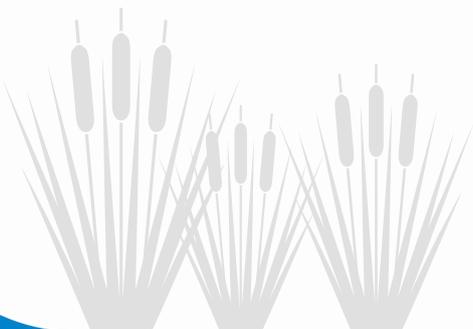


Saltmarshes, are made up of lots of different plants including grasses and reeds. They are inundated with seawater twice daily in the UK.

One of the main services a saltmarsh provides is supporting sediments to settle by slowing the energy of waves as they approach the shore.

Saltmarshes in the UK are known for being excellent places to see nesting birds in late spring and summer, including geese, sandpipers and herons.

Whilst Japanese culture love to incorporate seaweed into dishes, here in the UK Samphire a type of edible marsh plant that grows naturally. It is not seaweed and looks like a cactus crossed with asparagus, perfect for your fish and chips!



# ROCKY SHORE



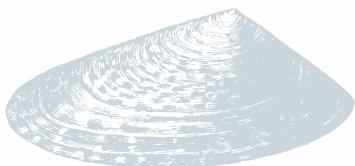
Rocky shores provide a home for lots of animals and seaweed to live.

This is an extreme environment controlled by intense periods of wave and tidal action. During low tide the animals and plants living here must be able to thrive during drought periods, especially in warmer countries.

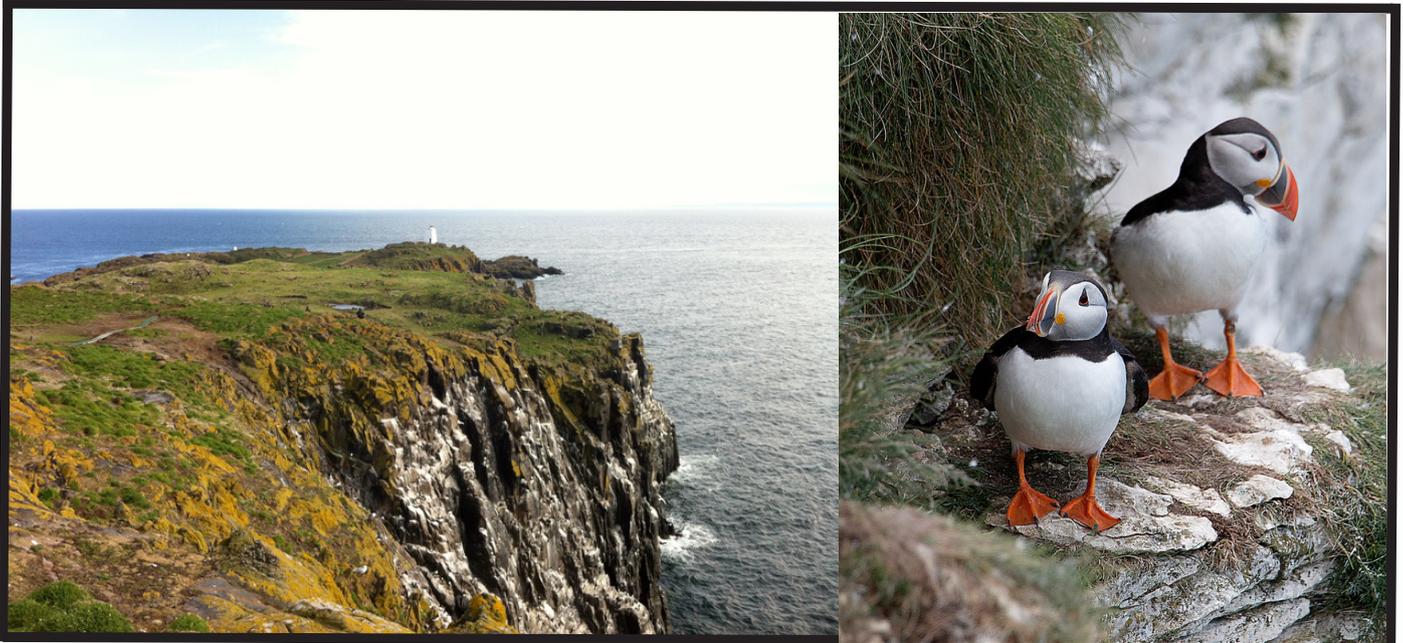
Regardless of this, because this habitat is incredibly stable, unlike beaches they contain a very high number of different plants and animals. The erosional features of a rocky shore create pools of mini habitats.

Many animals who live in rocky shores have adaptive features. For example:

- Animals, like limpets (a type of snail), who attach more firmly to the rocks during low tide to retain water.
- Crabs which are mobile, with their body protected by hard shell (exoskeleton), claws to help them scavenge for food during low tide.



# CLIFFS

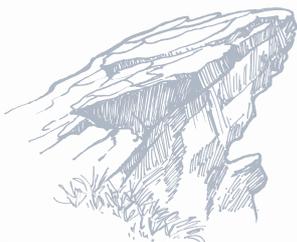


Sea cliff habitats are often overlooked, but these habitats provide a home for a range of unique plants and animals.

Here in the UK, there are lots of seabirds that use cliff ledges to nest, helping to keep their eggs safe from predators, such as foxes and rats. Many of these seabirds only come to land to breed, spending the rest of their time on the water, so it is important that these habitats are protected.

Gannets, guillemots and puffins are some of the more famous UK birds you can see nesting on cliffs!

Alongside the damage of sea level rise and erosion, sea cliff vegetation is highly susceptible to damage from recreational activities such as rock climbing, where in order to make routes safe they have to remove vegetation. This can lead to long-term vegetation loss and disturbance to nesting birds.



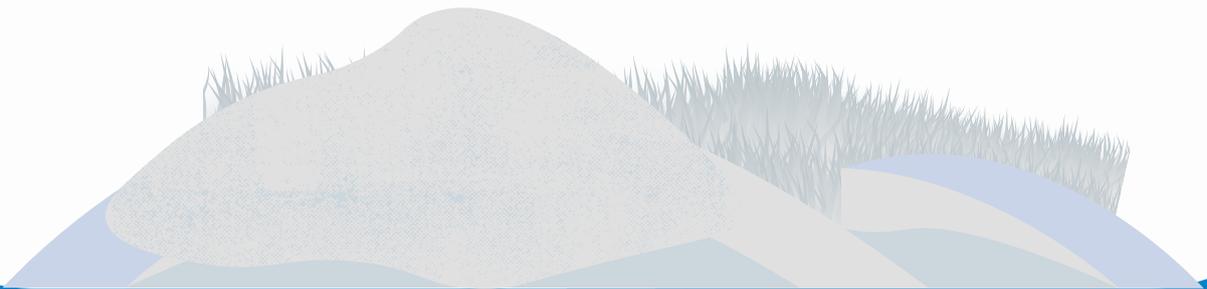
# SAND DUNES



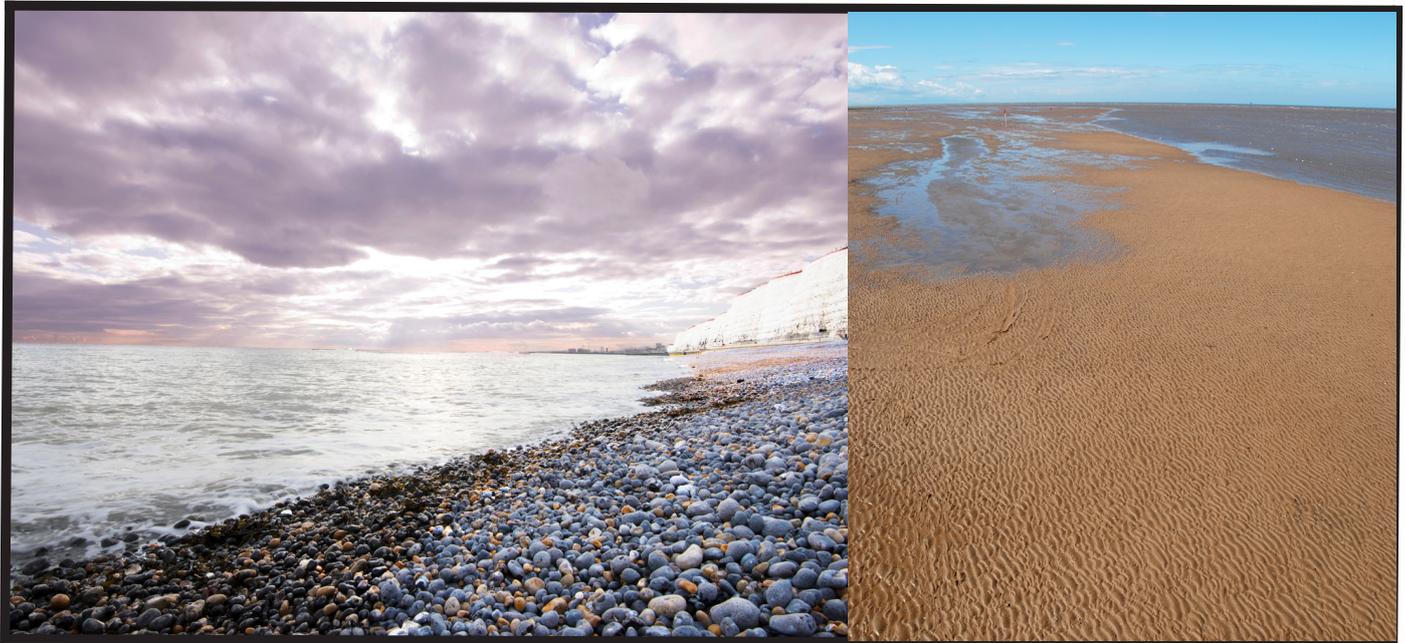
Sand dunes are incredibly fragile habitats, formed from wind and water driven sand movement. The dunes are comprised of loose sand that collects and forms ridges and mounds. Often when you visit a sand dune, they have boardwalks across them to protect them from erosion.

They can help maintain a beach where sand is retreating back into the water, reduce coastal flooding and provide shelter from the wind for coastal habitats and populations.

Sand dunes are often sites exposed to the elements, due to the loose nature of the sand they make excellent habitats for insects and bees, butterflies, beetles and dragonflies.



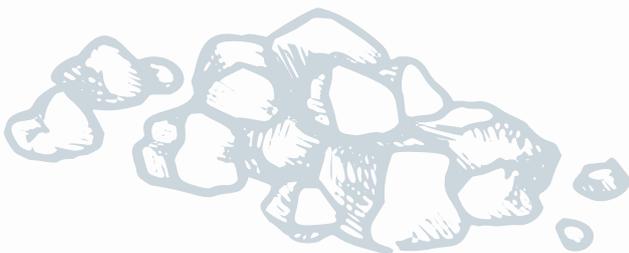
# SHINGLE AND SAND BEACHES



A shingle beach is usually made up a mixture of materials including pebbles and rocks and sand. They are usually steeper than sand beaches because of the way waves flow through and over the different materials that make up the beach. Sandy beaches are mostly made up of sands.

Beaches are incredibly important for tourism and lots of coastal towns and villages rely on them to support the local community.

Beaches that receive seaweed, plants and animal bodies help to support unique insects, crabs, lobsters and seabirds, by providing food and nutrients to the beach.



# ACTIVITY 4A: THREATS TO HABITATS



Dani has provided some threats to marine habitats.  
Are these relevant to your habitat?  
Are there more threats that are important to tell people about?

Coastal  
Erosion

Habitat  
Loss

Pollution

Flooding

Increased  
risk of storms



# ACTIVITY 4B: WAYS TO PROTECT TO HABITATS



Dani has provided some ways we can help protect marine habitats and reduce the impact of the things that threaten them.

Are these relevant to your habitat?  
Are there more ways we can protect marine habitats that are important to tell people about?

Conservation groups

Rewilding land

Reduce carbon footprint

Reuse and Recycle





People · Ocean · Planet

# #POPSCIKIT



MARINE ALLIANCE FOR SCIENCE AND TECHNOLOGY FOR SCOTLAND

**THE HABITAT I CHOSE TO LEARN  
AND SHARE ABOUT WAS...**

**I CHOSE TO SHARE ABOUT  
THE HABITAT BY...**

**I CHOSE THAT HABITAT BECAUSE...**

**I CHOSE TO SHARE ABOUT THIS HABITAT THIS WAY BECAUSE...**

**MY FAVOURITE FACT WAS...**



# #POPSCIKIT



**I CHOSE TO LEARN ABOUT HOW CLIMATE CHANGE IMPACTS...**

**I LEARNT THAT...**

**WHAT I WILL RESEARCH NEXT IS ...**

**I FEEL INSPIRED TO...**

Share with us so we can learn with you!

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