

# MARINE & COAST AUDIT

Name: \_\_\_\_\_ Grade: \_\_\_\_\_

## ***INTRODUCTION***

### **Have you ever visited the beach?**

#### **Cool Coastlines**

South Africa has an awesome coastline (the land that meets the sea). 2800km long! This coastline is home to some of the most beautiful beaches in the world.

Our coastline is also home to some big commercial ports from Cape Town on our west coast all the way round to Durban on our east coast. These ports are integral to our economy playing a role in the movement of goods in and out of our country.

The South African coastline has particularly rich, productive waters that contribute to our fishing industry. This includes offshore fishing for hake and mackerel as well as shoreline fishing and harvesting of perlemoen (abalone) and crayfish. SA also has a mariculture industry, sustainably growing sea food such as oysters, abalone, and mussels.

Millions also flock to our beaches in summer for a bit of sun, surf, and swimming.

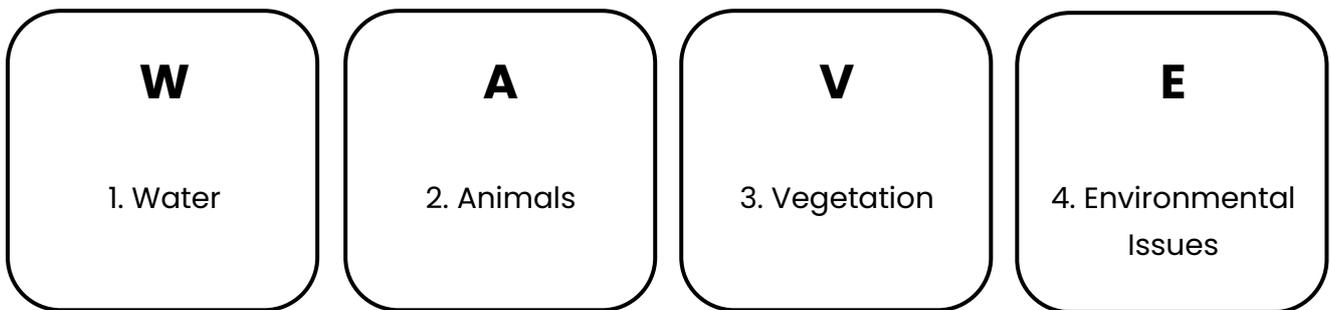
Our tourism industry is booming at the coastline with whale watching, angling and even shark cage diving.

Coastlines are also important breeding areas for marine birds as well as essential breeding and nursery areas for fish.

The ocean also has an important cultural and religious significance. Some people even believe that seawater has healing properties.

But there is more to coastlines than meets the eye, let's dive a little deeper and have a look at one of the most complex and important ecosystems on the planet.

It is time to "WAVE" at the ocean (I am pretty sure it will wave back).



## 1. Water

Coastlines are formed over many years by waves, tides, and currents. Waves crashing on the shore have a double effect. They erode the land, but crazily they also leave stuff behind that can build up the land. If you get a chance to walk along a beach, you might find treasures tossed out by the ocean - shells, rocks, beach sand. Over time these can accumulate and form new beaches!!

In South Africa we have both rocky shores (coastlines with hard rock substrate) and sandy shores (shores with, you guessed it, sand!). Rocky shores tend to support more life because they are more stable, while sandy shores tend to change quickly due to the smaller particles being moved by wind and waves.

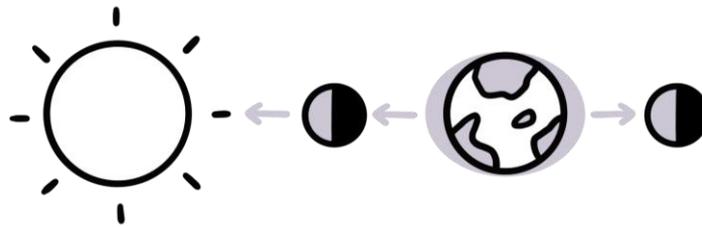
Coastlines are dynamic - this means that they are constantly changing. Tides can change beaches every day. Despite this they are amazing ecosystems with many unique animals and plants.

## Do you know how tides work?

Tides are caused by the moon. The moon's gravitational pull draws the earth's water towards it. This causes low tides on the side away from the moon and high tides on the side closest to the moon.

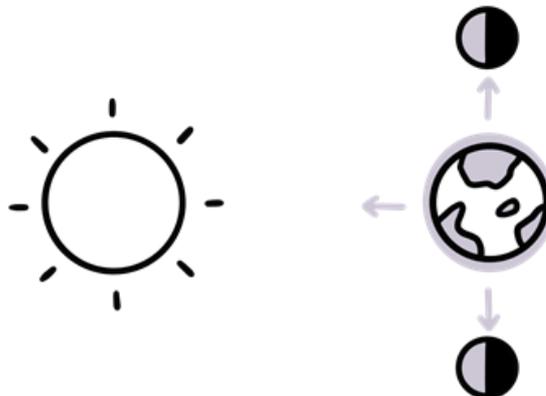
### Spring high and low tide

When it is either full or a new moon. The moon is in line with the sun and the gravitational pull causes the highest and lowest tides.



### Neap high and low tide

When the moon is in its first or third quarter, there is less of a difference between the high and low tide because the gravitational force of the sun and the moon are pulling in different directions.

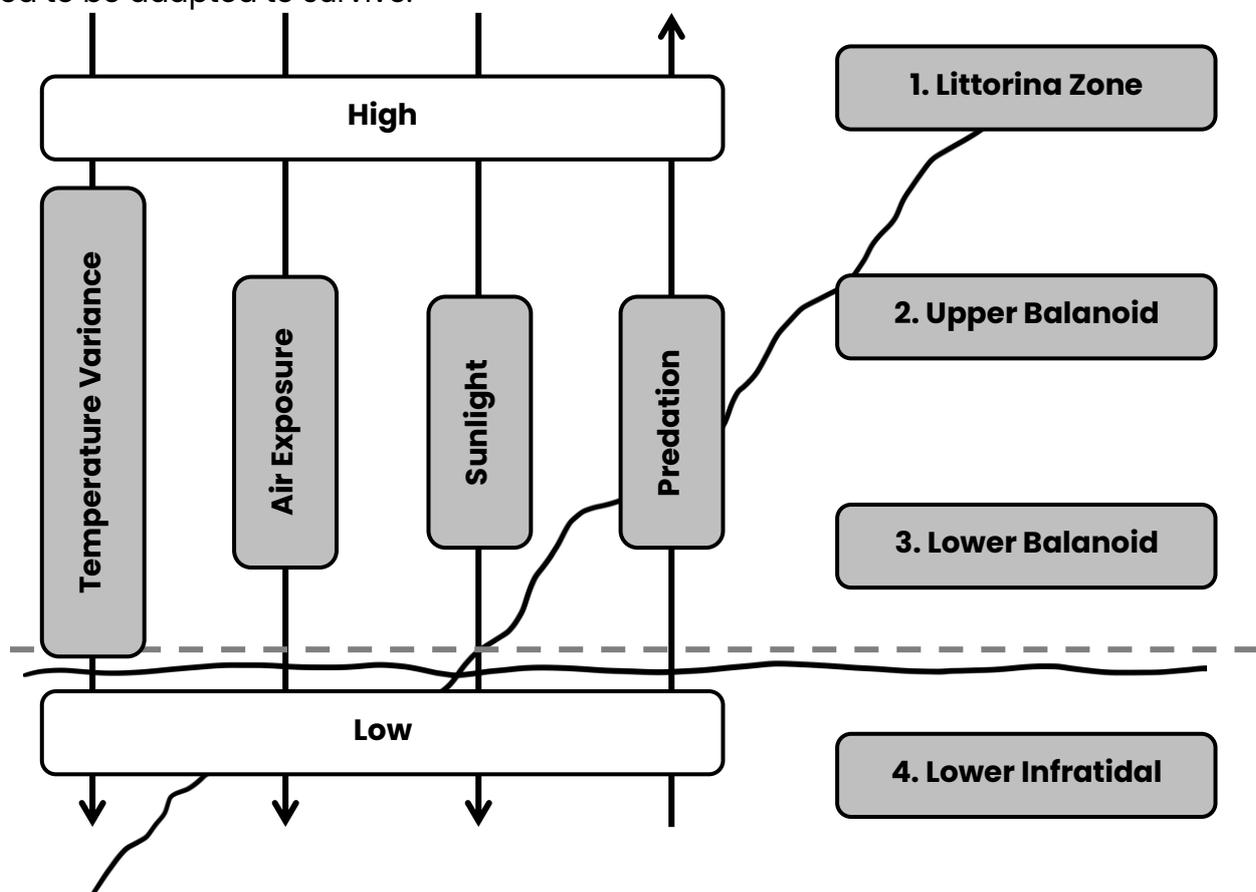


## ACTIVITIES

### 2. Animals and 3. Vegetation

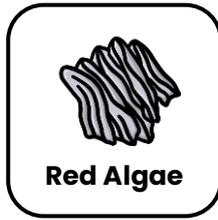
Coastlines are home to some of the most amazing animals and plants, adapted to the extreme environments that they live in.

Let's have a look at the rocky shore as an example. The shore is divided into several zones. Each zone has different environmental factors that the animals and the plants need to be adapted to survive.



- **The Littorina Zone (Zone 1)**

This zone is a high stress zone. It is mostly dry, except during very high tides. Few seaweed species can survive here. One seaweed that is tough enough to take on this challenge is purple laver (*Porphyra capensis*). Littorina snails are commonly found here - they can breathe air so do not need the water.



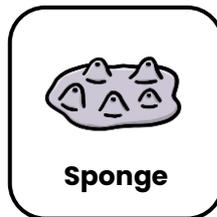
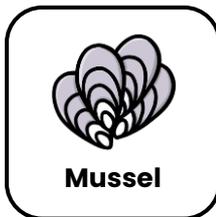
- **Upper Balanoid Zone (Zone 2) - also known as the barnacle zone**

This zone is dry for more than half of the day, has only weak waves and has very little seaweed. It is dominated by barnacles, limpets, and winkles.



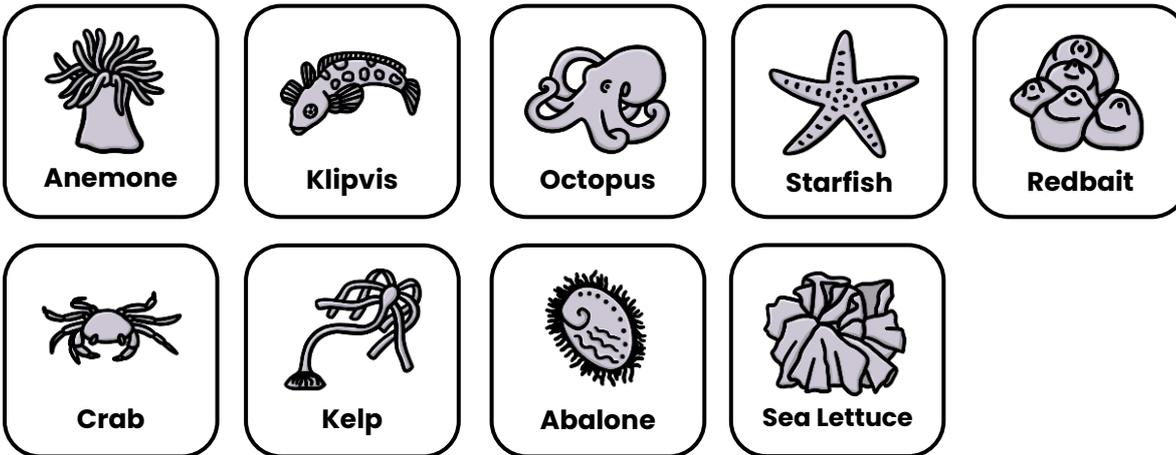
- **Lower Balanoid Zone (Zone 3)**

This zone is wet half the time and dry half the time. It has medium waves. This is the slippery zone because it has lots of seaweed present - look out for the coralline seaweeds, sponges, sea urchins, and brown mussels.



- **Infratidal Zone (Zone 4)**

This zone is under water the whole day. It experiences strong waves and a heavy predation pressure. It is the richest zone, full of sea urchins, anemones, starfish and if you are lucky even an octopus.



Using the diagram, please answer the following questions.

- Which zone do you think gets the hottest? \_\_\_\_\_
- Which is the driest zone? \_\_\_\_\_
- Which zone experiences the most wave action? \_\_\_\_\_
- Which zone experiences the highest levels of predation? \_\_\_\_\_
- Which zone do you think will support the highest level of biodiversity?

---

### Adaptations:

Animals and plants living on the rocky shore are exposed to many environmental extremes and have numerous adaptations to help them survive.

### Desiccation

Animals in the higher zones are often out of water and there is little shade. These animals and plants must stop themselves drying out.

Adaptations include:

- Behavioural adaptations like hiding in their shells, trapping water inside their shells, moving to wetter places (under rocks), clamping their shells against rocks, and even bunching together.
- Physical adaptations include streamlined shells, mucus production, reducing body size and using an operculum (plate) to close the shell opening.



### **Wave action**

Animals and plants need to be adapted to varying levels of wave action that can wash them off rocks.



Adaptations include:

- Physical adaptations like streamlined shells and a strong foot to attach to rock.

- Behavioural adaptations include hiding under rocks and retracting into their shells.



### **Predation**

Some zones of the shoreline have high levels of predators that need to be avoided.

Adaptations include:

- Physical adaptations - spines and camouflage and hard shells.
- Behavioural adaptations - retracting into your shell and moving fast



MARINE & COAST  
Grade 8 - 11 Audit

Fill in the missing boxes of the Adaptation Table. Use the zones profile and the information above to guide your ideas.

Environmental Stress	Adaptation	Example
<i>Desiccation (drying out)</i>	<i>Bunching</i>	<i>Littorina snail</i>
<b>Desiccation/wave action</b>		
	<b>Strong foot to attach to rocks</b>	
<b>Desiccation/wave action</b>		
	<b>Camouflage</b>	
	<b>Air bladders</b>	
<b>Predation</b>		

### 4. Environmental Issues

Our coastlines are amazing, but they are also under threat.

**Complete the crossword to work out the main threats to coasts.**

1	3													
											1			
2														
3													2	
	4													
	5			4										
6														

**Clues:**

Down

1. Process that results in movement of sand by wind and water (7)
2. The process of developing (12)
3. Process of becoming acidic (13)
4. Coke bottles are made of this (7)

Across

1. Sewage and stormwater (10)
2. An escape of oil into the ocean (7)
3. Obtain minerals (6)
4. Greta Thunberg is a ... activist (7,6)
5. Hot and cold (11)
6. Tending to spread rapidly (8)

**Did you manage to find all the words on your crossword?**

**Let's look at some of the issues in more depth.**

**1. Erosion and Development**

There has been an increase in human activity in coastal areas. This results in degradation of dune and beach systems and has left many coastal systems very vulnerable to erosion by wind and water. Coastlines are dynamic but currently many coastlines are eroding more rapidly than they would naturally.

This leaves adjacent areas susceptible to storms and flooding as well as damaging many natural habitats and causing loss of biodiversity.

<https://scitechdaily.com/extreme-sea-levels-to-become-far-more-common-worldwide-as-earth-warms/>

**Can you think of ways to reduce erosion?**

---

---

---

---

## 2. Wastewater

Did you know wastewater, sewage and storm water is commonly disposed of into the ocean – yuck!?! The ocean does provide an ecosystem service by recycling our disgusting wastewater, but the rate at which this poop water is now entering our oceans has overwhelmed the system. Cape Town and eThekweni have over 100 storm water drains directly into the ocean. This water contains heavy metals, human faeces, fertiliser, oils, and plastics all of which have a huge effect on coastal ecosystems.

- **How can we make sure our water going into the ocean is cleaner?**

---

---

---

---

## 3. Pollution – Oil spills and Plastic

Have you ever given much thought to how much rubbish ends up in the ocean? Two of the worst culprits are oil and plastics.

South Africa is a very busy shipping route, which leaves our waters exposed to oil spills. This is especially detrimental to marine mammals and sea birds. Oil destroys the ability of fur to insulate (keep the animal warm) and stops the water repellent ability of feathers. <https://sanccob.co.za/oil-spill-in-eastern-cape/>

Luckily, we have amazing organisations like SANCCOB (<https://sanccob.co.za/about-us/>) working to protect and save our sea life.

Many of our beaches are extremely polluted. Rubbish blows onto the beach from landfills, gets washed down storm water drains and even gets dropped by careless people. This is hazardous to both humans and animals. Birds can choke on plastic; seals can get tangled in fishing lines and floating plastic can block out light, killing algae.

Almost all fish caught today contain microplastics (tiny pieces of plastics) that they have mistakenly eaten thinking it was food. Some animals like turtles even starve to death because their stomachs become filled with plastic (they think plastic packets look just like a delicious jellyfish). Have a look at these blogs from the Two Oceans Aquarium in Cape Town, who do wonderful work saving our sea life.

<https://www.aquarium.co.za/blog/entry/removal-of-plastic-from-a-turtles-throat>

<https://www.aquarium.co.za/blog/entry/the-rehabilitation-of-bob-the-turtle>

- **What can you do to STOP plastics reaching our oceans?**

---

---

---

---

#### **4. Sand and Mineral Mining**

Copious quantities of sand are being removed (often illegally) from dunes and beaches to be used in the building industry. This can cause many issues including, changes in water flow, erosion, reduced flood, and storm surge protection as well as loss of habitats and biodiversity.

#### **5. Climate Change**

Climate Change, I bet you have heard of it. The global average temperature of the earth is expected to rise over the coming years, and it is going to cause endless problems. One of the big issues is the rise of sea level due to the melting of the ice caps.

Some of our coastal towns are especially vulnerable to this rise in sea level. Along with the climate change is an increase in the severity of storms and a rise in flooding of coastal areas.

## 6. Temperature Increase

Due to elevated levels of greenhouse gases in the atmosphere, heat is becoming trapped. Much of this heat is stored in the ocean resulting in a significant increase in ocean temperature over the years. This can cause coral bleaching as well as high levels of mortality in marine birds, mammals, and fish.

<https://news.mongabay.com/2015/10/massive-bleaching-event-puts-worlds-coral-reefs-at-risk/>

## 7. Acidification of Oceans

Due to an increased absorption of CO<sub>2</sub> the oceans are becoming more acidic. This has big impacts on ocean animals that need to create shells – like oysters, limpets, and snails. Molluscs make their shells by using calcium and carbonate from sea water. As seawater becomes more acidic, carbonate ions bind to hydrogen ions in the water. This results in fewer carbonate ions available to build shells.

**Here is an easy experiment to show the effects of acidification on shells.**

You need:



- Two jars
- Water
- Vinegar
- Two similar shells

Record your experiment using the scientific method.



**Step 1:**

Place one shell in each jar and label clearly.



**Step 2:**

Add vinegar to one jar and water to the other. Make sure your shell is covered.



**Step 3:**

Examine the jars and shells after 4 hours and then again after 24 hours.

**Discussion Points:**

- Was there a difference between the shells?
- What do you think happened to the shells?
- What does this mean for animals in the oceans with shells?

**8. Invasive species:**

South Africa coastal waters are home to a variety of invasive species, many of which were introduced through ballast water or hull fouling from ships entering south African waters.

Ballast water - this is water held in ballast tanks in ships that can be used to help stabilise the ship.

These invasive species can cause loss in biodiversity that also has knock on effects in the commercial fishing industry.

*Example: The Mediterranean mussel (Mytilus galloprovincialis) is a declared invasive mussel species from the Mediterranean. It has colonised several localities along the South African coastline.*

It rapidly spreads displacing indigenous mussel and limpet species BUT it has also been shown that the endangered African Black Oystercatcher will switch to feeding on these over indigenous mussels which in turn increases the Oystercatcher's reproductive potential.

- **Can invasive species have positive effects?**

---

---

---

---

- **How do you balance positive and negative effects?**

---

---

---

---