

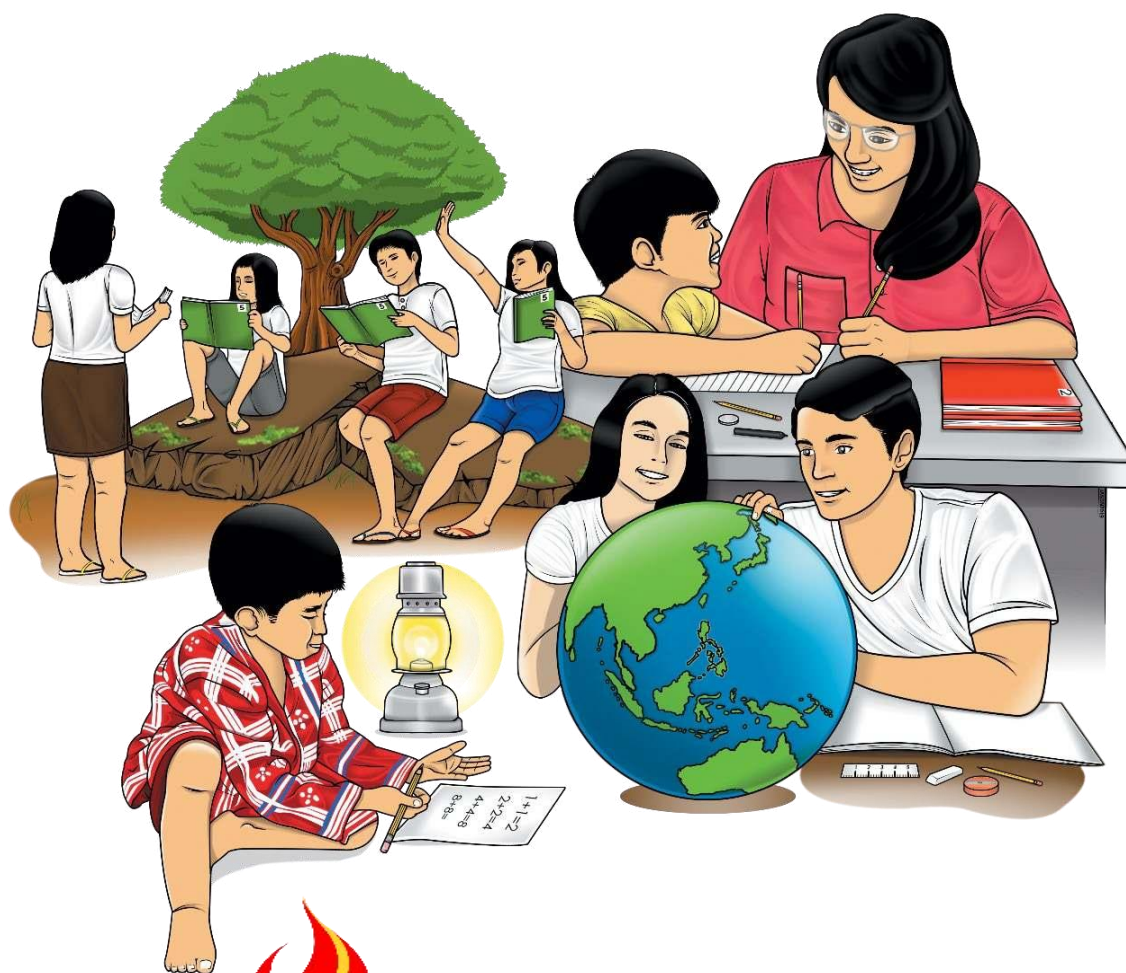
Senior High School



# Earth and Life Science

Quarter 1 – Module 19:

Marine and Coastal Processes



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*Quarter 1 – Module 19: Marine and Coastal Processes*

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## ***What I Need to Know***

This module was designed and written with you in mind. It is here to help you master the nature of Earth and Life Science. The scope of this module permits it to be used in many different learning situations. The language used recognizes the diverse vocabulary level of students. The lessons are arranged to follow the standard sequence of the course. But the order in which you read them can be changed to correspond with the textbook you are now using.

The module is composed of one lesson, namely:

- Lesson 1 – Effects of Marine and Coastal Processes

After going through this module, you are expected to:

1. describe how marine and coastal processes result to coastal hazards (S11/12ES-Ih-38); and
2. explain how coastal erosion, submersion and saltwater intrusion occur (S11/12ES-Ih-38)

**Lesson****1****Effects of Marine and Coastal Processes**

The coast is one of the most dynamic parts of the Earth's surface. It contains some of the world's sensitive and threatened ecosystems such as mangroves and beach forest, seagrass, and coral reefs. The dynamics of the marine environment result to different processes that affect human communities and organisms in the coastal ecosystem. Some of these processes result to natural hazards.

Marine systems are referred to as the world's oceans while coastal systems refer to the interface between oceans and land, extending seawards to about the middle of the continental shelf and inland to include all areas strongly influenced by the oceans (Millennium Ecosystem Assessment, 2005). About 23% of the world's population live within 100 km of the coast and about 10% live in extremely low-lying areas. Many of these processes like coastal erosion, storm surges, coastal flooding, and tsunami.



*Figure 1. Beach coast in Calatagan, Batangas (Photo taken by M. Cudiamat)*

**What's In**

Coastal processes are activities that regularly happen in the marine ecosystem as influenced by the weather, climate, and the adjacent landscape. Let us check your understanding about coastal and marine processes.

**Activity 1: Word Decoding**

**Directions.** Rearrange the jumbled letters and identify the term being referred to in each of the following items. Write your answer on the space provided.

1. These are caused by the gravitational pull between the moon and Earth.

E	I	T	S	D

2. They are formed by the wind and storm in the ocean.

A	W	V	E	S

3. This is caused by the melting of glaciers and iceberg.

E	S	A	E	V	L	E	L	E	S	I	R

4. It refers to the motion of the outermost shell of the Earth.

S	A	C	U	R	L	T	N	T	E	V	M	O	M	E

5. This is the rising of the seawater due to atmospheric conditions.

U	R	E	G	S	R	M	T	O	S

## Activity 2: My Picture of Human and Coastal Environment

**Directions.** On the box provided below, draw a coastline that will show the interaction of humans and the coastal environment using the coastal terms listed below. Then, describe your illustration in not less than 3-sentences.

Humans

Beach

Coastal forest/trees

Estuary/river

Waves







## What's New

### Revisiting Marine and Coastal Processes

What have you noticed about the terms used in the previous activity? Actually, these are all marine and coastal processes. The scientific field dealing with these processes happening in our major oceans and seas is called **oceanography**. It is an interdisciplinary field of science that integrates the different fields such as physics, chemistry, biology, geology, meteorology, mathematics and even the social sciences to understand the link between humans and oceans. **Coastal processes** are activities or events happening in the marine environment. These are driven by the different environmental factors such as atmospheric pressure, temperature, movement of the Earth, moon, and other dynamic changes in the ocean.

Now, let us talk about the different coastal processes in details.

**Coastal processes** include waves, tides, sea level change, crustal movement, and storm surge. **Waves** are caused by the movement of the air masses in the coastal environment. **Tides** refer to the gravitational pull between the Earth and the moon. **Sea level change** is a result of the rise of ocean water which can be attributed to the melting of glaciers or iceberg in the polar regions. **Storm surge** refers to the rising of seawater due to changes in pressure and wind associated with a storm. **Crustal movement** is caused by the motion of the oceanic and continental crust of the Earth.

### Effects of Marine and Coastal Processes

The different coastal processes described above may result to coastal hazards. **Coastal hazards** are physical phenomena that expose the marine environment to risk of property damage, loss of life and ecological degradation (Figure 2)

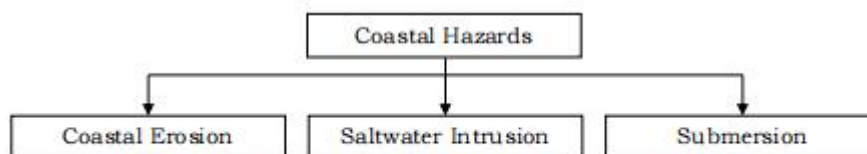


Figure 2. Concept map of coastal hazards

### Coastal Erosion

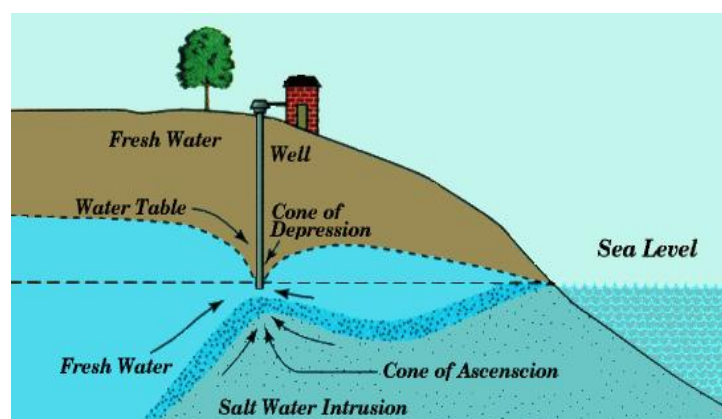
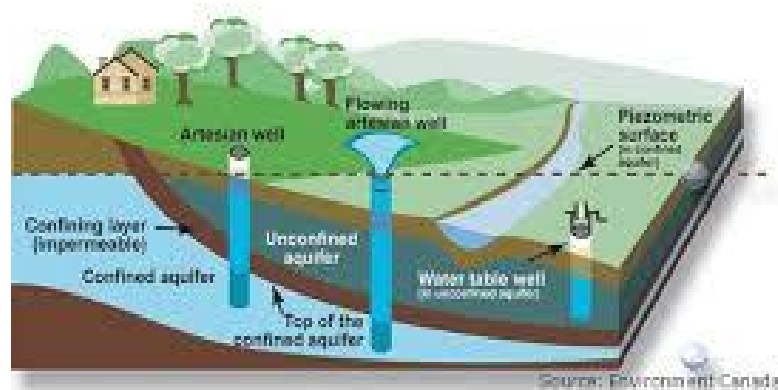
It is the loss or displacement of land along the coastline due to the action of waves, currents, tides, wind-driven water, or other impacts of storms. Coastal erosion is a type of coastal hazard which is brought about by the different coastal processes.



*Figure 3. Coastal Erosion*

### ***Saltwater Intrusion***

It is a major concern commonly found in coastal aquifers around the world. An **aquifer** is an underground layer of permeable rock, gravel, sand or silt. Groundwater from an aquifer is usually extracted by a water well. Once an aquifer becomes contaminated it becomes unusable anywhere from 2 weeks to 10,000 years. Saltwater intrusion is the induced flow of seawater into freshwater aquifers primarily caused by groundwater development near the coast.



*Figure 5. Saltwater intrusion*

### ***Submersion***

It refers to the movement of coastal sediments from the visible portion of a beach to the submerged nearshore region of the coast.



Figure 6. Submersion



## What Is It

The figure below shows the link between marine and coastal processes and coastal hazards. These processes could lead to hazards in the coastline that can be mitigated through different coastal management techniques which you will study in the next module.

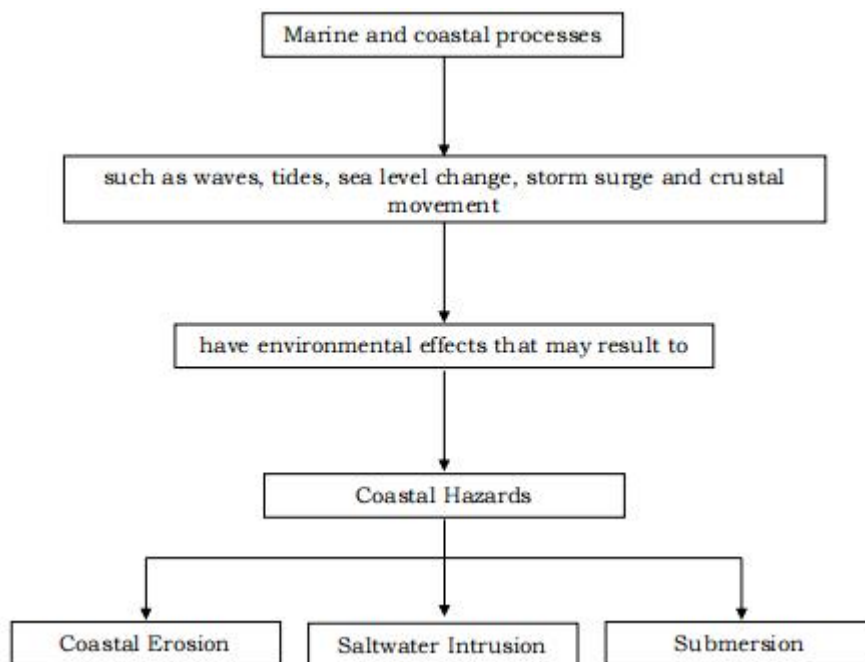


Figure 7. Concept map of the relationship between marine and coastal processes and coastal hazard



## What's More



### Activity 3. Picture Analysis

**Directions.** Look at the pictures presented below. Describe how prone or vulnerable the places are to coastal hazards. Answers must be at least 2 sentences.

1.



2.



3.



### Activity 4. Poster Making

**Directions.** Prepare a poster with the theme: “Coastal Processes and their Impacts to Society”. Scoring criteria are as follows:

Relevance to the theme

4 points

Creativity  
3 points  
Originality  
3 points  
**TOTAL**  
10 points

Post your draft here.



### ***What I Have Learned***

**Directions.** Answer the given questions in a concise but substantial manner.

1. What happens when submersion, coastal erosion and saltwater intrusion occur?

2. Why is it important to study coastal and marine processes?



### ***What I Can Do***

**Directions:** As a Senior High School student, how can you help the local government to mitigate the harmful effects of coastal and marine processes such as coastal erosion, submersion, and saltwater intrusion assuming that your community is prone to these coastal hazards.



## Additional Activities

**Directions.** Read the article below from the Philippine Star in relation to the effects of marine and coastal processes.

### A. Coastal Erosion

#### **MGB: Coastal erosion caused Zambales beach collapse by Rhodina Villanueva (The Philippine Star) - July 2, 2013 - 12:00am**

MANILA, Philippines - The Mines and Geosciences Bureau (MGB) yesterday said that the collapse of the coastline of a beach resort in Candelaria, Zambales does not constitute a sinkhole phenomenon but was a result of coastal erosion. MGB Director Leo Jasareno said they are recommending that the area be declared permanently as a no swimming and danger zone as well. Jasareno said with the use of ground penetrating radar (GPR) equipment, a team of geologists who investigated found no voids or cavities, or even a sinkhole in the affected area. What was identified were alternating layers of loose and fine to coarse sand 18.5 meters below the surface, he said.

The equipment functions like an X-ray that can check land sinking up to 100 meters or 300 feet below. The beach slump is not due to sinkhole but is a result of coastal erosion caused by wave and tidal currents. Waves undercut the base of the shoreface, which happened during the interface of low tide and high tide, with the prevailing southwest monsoon, the MGB report said. Jasareno noted that the area is underlain by unconsolidated beach sand that is unstable and easily reworked by waves.

The coastal sedimentation dynamics is indicated by the advance and retreat of the shoreline, and that the area is also prone to storm surge hazard, he said. He said coastal erosion is a natural phenomenon leading to the formation of a cliff 100 meters from the shoreline. The depth of the cliff or the steep slope from the shoreline is about 25 to 30 meters. The MGB recommended continuous monitoring of the area for large-scale erosion and storm surge, particularly when there is an incoming weather disturbance. A danger zone should be declared as the area is highly prone to coastal erosion, he added. The MGB estimated the danger zone to be 100 kilometers long and the width to be 20 to 30 meters.

Answer the following questions based on the article you have read.

1. What is the article all about?
2. How did the MGB define coastal erosion?
3. What is the recommendation of the MGB about the issue?

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