

Name: \_\_\_\_\_ Period: \_\_\_\_\_ Date: \_\_\_\_\_

**Ms. Randall Marine Science**  
***Coastal Processes Lab Activity***

**Introduction:** Sand and other materials are moved along the shorelines by waves and currents. This occurs seasonally as well as during storms. Coastlines are not as stable as many people believe, but change their shape due to natural forces and the interference of people. As the percentage of the United States population living along the coastlines increases, so does the need for strategies and facilities to combat the potential threat due to future catastrophic storms and resulting flooding and coastal erosion. Erosion is comprised of natural, physical, and chemical processes by which the earth's rocks and soil are continuously worn down. Running water is also a major cause of erosion. Stones carried with a river's current scour and abrade the banks and beds. Ocean waves and currents erode rocky cliffs and sandy beaches, especially during storms. When an area receives more water than the ground can absorb, the excess flows to the lowest level, carrying loose soil with it. Erosion causes constant changes in land.

**Objective:** The purpose of this lab is to familiarize you with the kinds of shoreline features that exist, particularly along the coastline and the forces and conditions that produce them. You will also consider how humans use these features.

**Vocabulary:** Use the textbooks to define the following terms.

Longshore current: \_\_\_\_\_

Beach \_\_\_\_\_

Barrier beach \_\_\_\_\_

Lagoon \_\_\_\_\_

Inlet \_\_\_\_\_

Tidal Delta \_\_\_\_\_

Washover fan \_\_\_\_\_

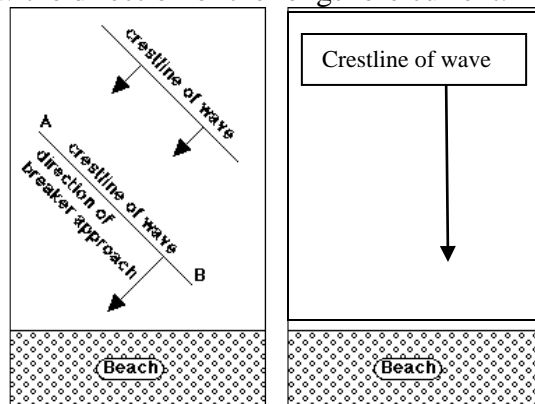
Groin \_\_\_\_\_

Tombolo \_\_\_\_\_

**Activity 1: Longshore Currents**

Longshore currents are maintained by the wave energy component travelling **parallel** to the shoreline, which causes part of the water mass to be transported along the shoreline as well. The figure below shows that waves approaching from the right generate a longshore current that runs to the left. This is because there is a component of wave velocity to the left. If breakers are approaching *perpendicular* to the shoreline, longshore currents will *not* form because there is no horizontal component of wave energy parallel to the shoreline. Longshore transport of sand is caused by the longshore current in combination with the stirring up of sand by wave action.

- Circle the diagram in which you could observe a long shore current.
- Use a colored pencil to draw the direction of the longshore current.



## Activity 2: Deltas

A delta develops when sediments pile up at the end of a river. The sediments can block the river, causing it to split into smaller rivers called “distributaries.” The distributaries spread out, each finding their own way through the sediments and down into the sea, sometimes giving the delta a triangular-shape. (The Greek letter “delta” has the shape of a triangle.) If enough sediment blocks the river, the river can actually shift its course.

1. What famous river feeds the delta in Egypt? \_\_\_\_\_

When you think of Egypt, you probably think of pyramids and a barren place covered by sand, but the delta is a green place with lush vegetation. The great ancient civilizations (e.g., Egypt, Mesopotamia, China, India) started in deltas because of the rich farmland.

2. Many people still live in deltas, but unlike ancient peoples, we have the technology to keep the delta from changing. For example, we dredge the river and distributaries (removing sediments from the bottom) and build levees (big piles of sediment).  
Why do we carry out these activities? What is the purpose or goal?

Dredging the River: \_\_\_\_\_

Building Levees: \_\_\_\_\_

3. Building levees can harm the nearby wetlands. How?

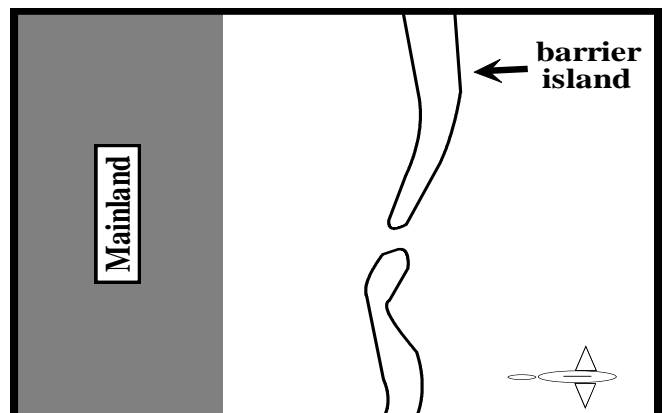
**Hint:**  
Levees control the river and its distributaries. What do they keep neighboring wetlands from getting?

Natural deltas are places where land is growing along a shoreline. New Orleans is built on a delta, but it is slowly sinking: new mud is no longer being added and the weight of the buildings is slowly squeezing out the water beneath it and compressing the mud. New Orleans is now about 8 feet below sea level, on average. The levees are the only thing keeping the Mississippi river and the ocean out.

## Activity 3: Barrier Islands, Bars, Spits, and Tombolos

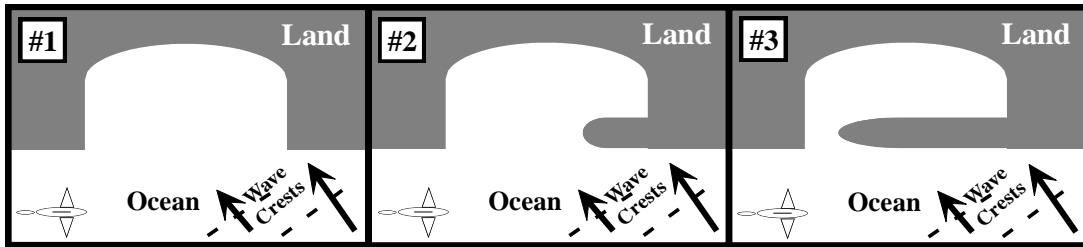
Examine the picture to the right

1. Are barrier islands made out of solid rock or sand? \_\_\_\_\_
2. In the map view (bird’s-eye view) on right, label the:
  - ocean
  - lagoon (estuary)
  - sandy beach

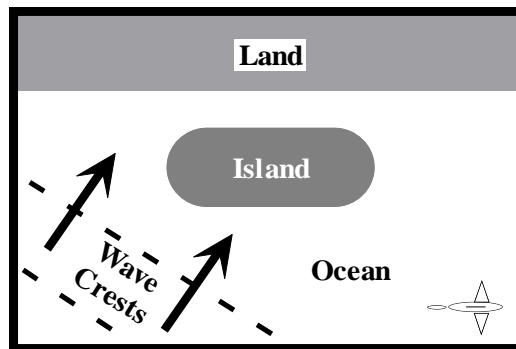


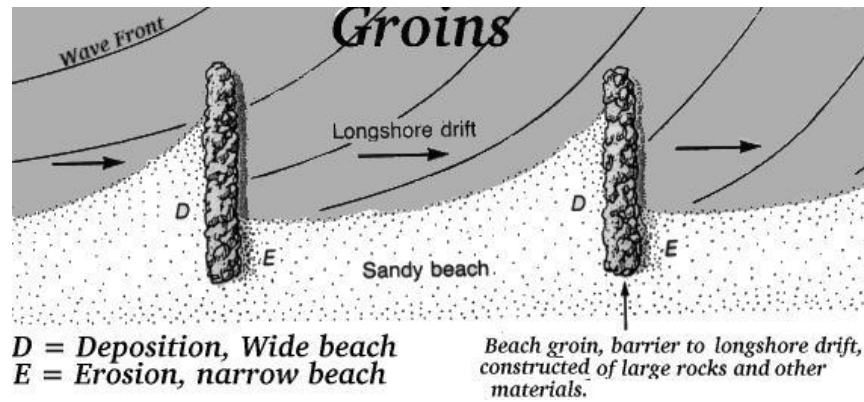
3. Examine the picture of Rodeo Lagoon.

The sketches below show how a “barrier bar” can develop. In your own words, describe how a barrier bar forms across the mouth of a bay or cove. As part of your answer, identify what pushes sand along the coast.



4. Sometimes sand will pile up between an island or sea stack and the shore, connecting island to the land (this is called a “tombolo”). Why does the sand pile up between the island and the shore?



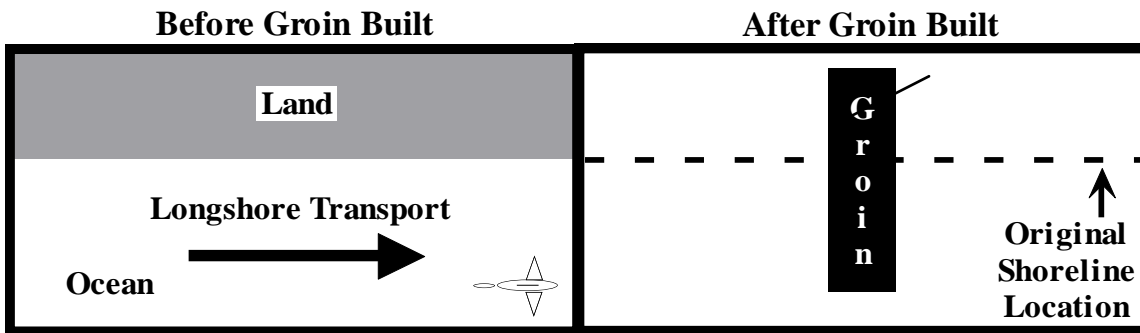


**Activity 4: Groin**

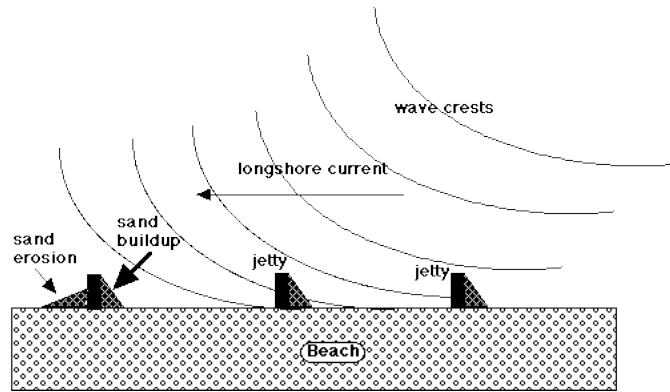
The shoreline is not stable; waves erode the shoreline and shift sediments, removing them from some places and depositing them in other places. However, when someone buys a piece of property, they don't like it to change. Humans often build structures called "hard stabilization" along the shoreline to prevent changes from occurring.

One common example of hard stabilization is a groin (see the "Hard Stabilization" pictures), a barrier than extends out into the ocean. Typically, groins are built to hold sand on a beach.

- Using the above picture as reference, sketch a map view (bird's-eye view) of how building a groin will affect the shoreline into the "After Groin Built" map on the right below. Label the land and the ocean.



- Write "sand deposited" in *green* and "sand erodes" in *red* in appropriate places in your sketch above. Why does sand pile up on one side of the groin? Why is sand being removed from the other side?



Jetties are similar to groins. Typically, jetties are longer than groins and come in pairs on either side of the opening of a harbor.

3. Jetties are built for the harbor, not to hold onto a beach.

How do the jetties benefit people who use the harbor?  
Give 2 examples.

(a)

(b)

**Hints:** (a) Think about riding in a boat and how jetties will affect the waves in the harbor (b) why boats would not be able to get in and out of the harbor *eventually* if there were no jetties.

Which is the primary purpose of the jetties? \_\_\_\_\_

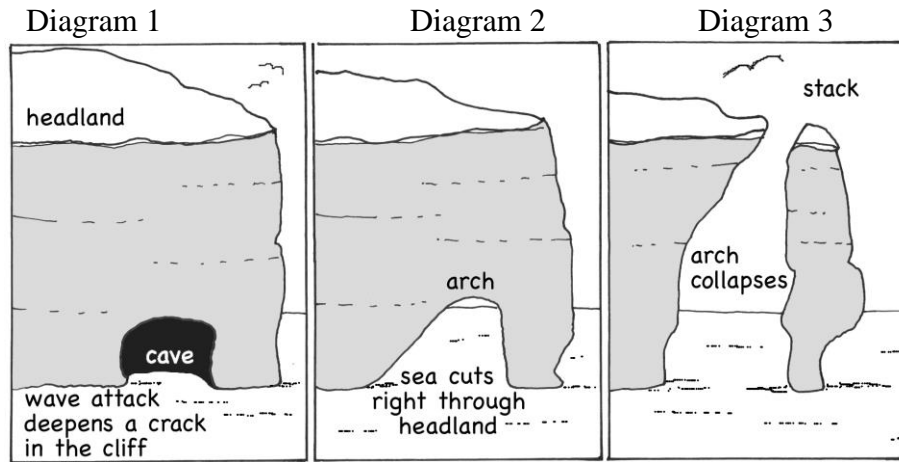
### Activity 5: Rocky Coastline

On rocky coasts, coastal erosion results in dramatic rock formations in areas where the coastline contains rock layers or fracture zones with different resistances to erosion. Softer areas become eroded much faster than harder ones, which typically result in landforms such as tunnels, bridges, columns, and pillars.



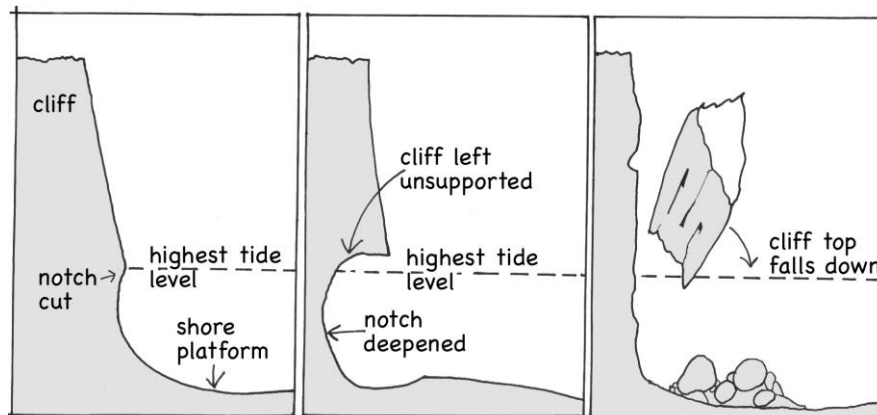
1. **Caves, stacks, arches, and stumps-** In quite strong rocks that are well jointed such as chalk, rain and seawater may erode some joints and cracks in the rock much more severely than the others, creating a hole or hollow in the cliff face (Diagram 1). This happens particularly on exposed headlands where wave action is very strong. The water swirls around in the hollow, quickly widening and deepening it, forming a cave. This cave may then be eroded backwards, and, if it is on a headland, it may meet a cave

wearing in from the other side. An arch is then formed through the cliff (Diagram 2). Eventually, the top of the arch or bridge collapses, leaving a stack (Diagram 3). This is exposed to erosion on all sides and is worn away and undercut until it collapses, leaving a stump. In time, wave action destroys much of the stump, leaving only its foundation or base well below wave level.



## 2. Cliff Collapse

a) Study the three diagrams, and then fill in the missing words in the three paragraphs below, using the words shown in the box. Perhaps use pencil to begin with!



The sea \_\_\_\_\_ the base of the cliffs, by the processes of \_\_\_\_\_, hydraulic action and abrasion. This occurs mainly below the level to which the \_\_\_\_\_ reach, and leaves a \_\_\_\_\_ at the base of the cliffs. The upper part of the cliff is then left \_\_\_\_\_ by the erosion so that the cliff is top-heavy and not well supported. The cliffs are also attacked by \_\_\_\_\_. For example rain and salt laden sea spray may soak into the \_\_\_\_\_ widening them, weakening the rocks and \_\_\_\_\_ attacking the minerals. In winter, this moisture trapped in the rocks may \_\_\_\_\_, expanding and widening the joints, and shattering the rock. The erosion of the \_\_\_\_\_ and the weathering of the cliff- face result in \_\_\_\_\_, which can be massive, sudden and dangerous. As the falls occur, the cliffs are gradually worn backwards and \_\_\_\_\_ leaving a platform at their base, called the \_\_\_\_\_.

chemically, undercut, base of the cliff, wave-cut notch, shore platform or wave-cut platform, erodes, weathering, cracks and joints, abrasion, cliff falls, freeze into ice, retreat, wave pounding, highest tides or the storm waves

