# *Gulf Shoreline* Teacher's Guide

**Subject:** Integrated Science (Life; Earth-Space; Physical)

**Topics:** Agents in shore line erosion and deposition. Wind, wave action, energy

**Summary:** Students will observe and measure properties of ocean waves, wind speed and direction, and observe the impact these forces have on the physical environment.

**Objective(s):** After completing the field lab, students will be able to:

1. Describe the characteristics, formation, energy forms (potential, kinetic) of waves.
2. Explain how energy from waves affects a shoreline
3. Describe how sand moves along the beach

**Ecosystem(s):** Coastal, Beaches/Dunes

## Equipment:

- Waterproof stopwatch
- Sand Gauge (optional)
- Field Microscope
- Anemometer
- Petri Dish (plastic)
- GPS
- Nylon line 6 m
- Line level
- Towels
- Safety whistle
- Transect tape measurer
- 6 x yellow tennis balls
- 2.5 Meter measuring rod with 2 Large colored rubber bands
- Breaker Reference Chart
- 4 x 1meter stakes

## Background:

- Vocabulary: wave, energy, shoreline,
- Reference Material: National Geographic Wave Simulator: http://www.nationalgeographic.com/volvooceanrace/interactives/waves/index.html
  Motion in waves: http://www.geocities.com/CapeCanaveral/7639/oceans/wavid.htm
  Making and Using a Wave Machine (Extension): http://sealevel.jpl.nasa.gov/education/activities/ts2enac1.pdf
  Wave Energy and Coastal Landforms: http://www.physicalgeography.net/fundamentals/10ac.html
- Equipment Training: Field Microscope, GPS, Anemoter

## Field Lab Procedure

1. Ask the students to speculate about how waves are formed. Then, ask the students to describe what happens when waves reach the shoreline.
2. Explain that each group will be making observations and recording data on different parts of the beach. Describe and demonstrate the use of the equipment, and the proper units for each measurement for each group.
3. Break students into three groups: 1) *surfers*; 2) *beachcombers*; and 3) *lifeguards* and explain the general procedures for each group. Be sure to determine the general orientation of the beach, identify the place where sand is to be collected, and place the stake for marking longshore drift and beach slope.
   - ***Surfers*** use the measuring rod and stopwatch to measure the wave height and frequency. Mark the lowest water level and the highest level on the measuring rod with hair bands. Measure the number of waves per minute using the stopwatch (take three measurements and average. Measure the slope of the beach by placing stake at the highest point the waves reach on the beach and running a 6 meter line from the base of the stake into the water (perpendicular to shoreline) to the measuring rod. Use the line level to ensure the line is horizontal from the base of the stake to the measuring rod. Measure the height of the line on the measuring rod. Note breaker type using reference chart.

- ***Beachcombers*** use the field microscope and sand measure and compare the average sand grain size at different locations near the shore. Take a pinch of wet sand from the highest point reached by waves on the beach and place on one side of Petri dish. Take another pinch of sand from the area where waves are breaking and place on the other side of the Petri dish. Compare both samples under the field microscope (which is larger? What other differences are visible?). Beachcombers also measure the direction and speed of longshore drift by tracking the movement of tennis balls (one for each person in the group) placed in the water where the waves are breaking. Mark the starting point with a stake and time movement for 5 minutes (repeat if time permits. Measure the distance traveled by each ball using the measuring tape. If the ball washes ashore before the time is up, gently roll it back into the wave. Record the average distance traveled. Also, note the direction of longshore drift using compass bearings.
- ***Lifeguards*** use the GPS and Anemometer to measure the orientation of the beach(the compass headings on either end of a line parallel to the beach), direction and speed of wind, the direction of approach (compass bearing or degrees) for the waves, and tide status. Lifeguards also monitor the work of the surfers and blow the safety whistle if they notice any potential hazards/emergencies.

4. After all groups have completed their measurements, they re-group and share their data.

## Sunshine State Standards

**Science**: SC.B.1.3.1, 2, 3, 4, 6; SC.B.2.3.1; SC.C.1.3.1; SC.D.1.3.1; SC.H.1.3.4; SC.H.2.3.1
**Language Arts**: LA.A.1.3.3; LA.B.2.3.1; LA.C.1.3.1
**Mathematics**: MA.A.1.3.1; MA.B.1.3.2; MA.B.2.3.1; MA.B.3.3.1; MA.B.4.3.1; MA.E.3.3.1
**Social Studies**: SS.A.6.3.2

# *Gulf Shoreline* Student Data Sheet

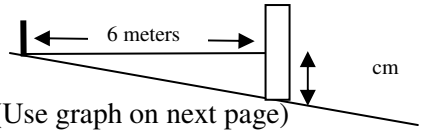
## General Information

| | | | |
|---|---|---|---|
| Full Name: | | Date: | |
| School (teacher): | | Time: | |
| Latitude: | | Longitude: | |

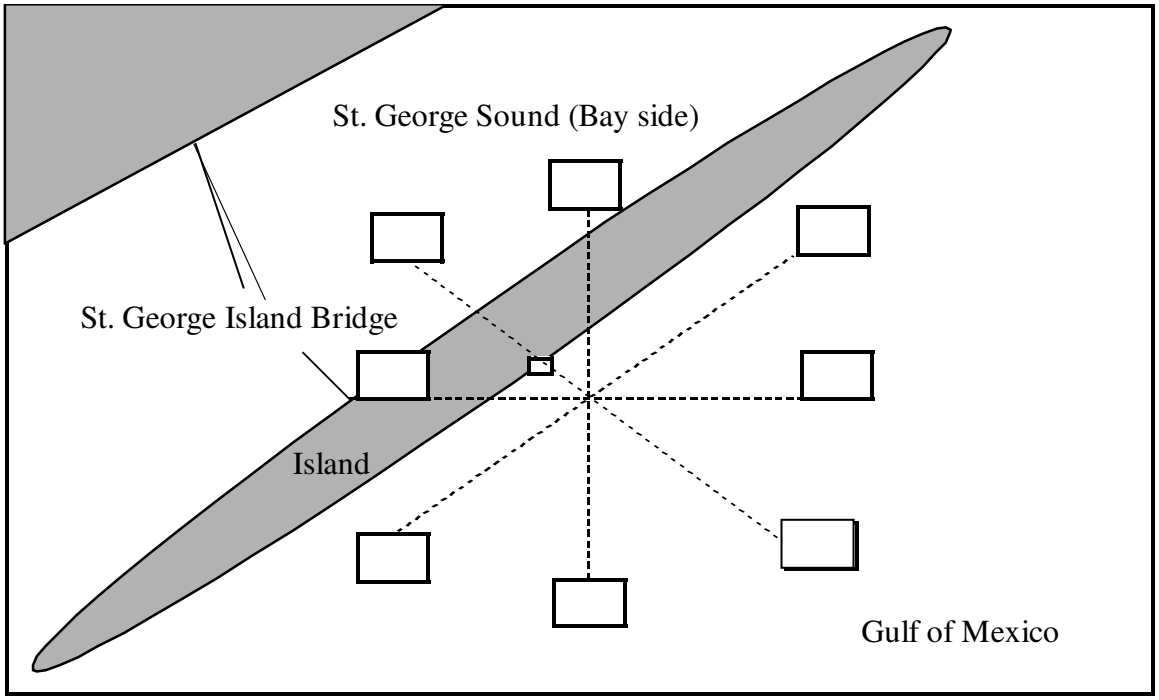
## Student Hypothesis and Rational

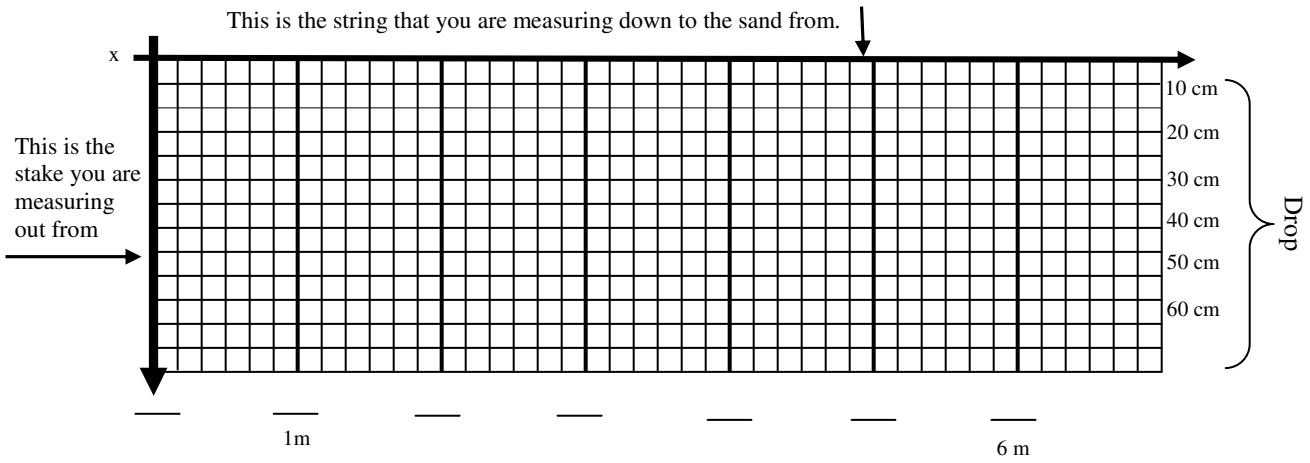
If the size of sand particles is associated with wave movement, than I hypothesize that the larger sand and shell particles will be located where the waves (choose one: break/ reach furthest up the beach) because..._____
_____

## Field Observations/Measurements/Data

| Group | **Measurement** (units) | **Recordings** |
|---|---|---|
| **Surfers** | Frequency (waves per minute) [average three, one-minute counts] | |
| | Type of Break: spilling (very flat beach), plunging (steep beach), surging (very steep) | |
| | Slope of beach (record height of string at 1 meter intervals) |   (Use graph on next page) |
| **Beachcombers** | Compare sand/particle size at highest point on shore reached by waves and where the waves break and mix [use sand gauge]. Which has larger particles? (circle one) | Highest point (slow moving)<br>Breaking / mixing point (fast moving) |
| | Longshore Drift (average distance of tennis ball travel and compass heading) [m/5min] | |
| **Lifeguards** (use map on next page) | Orientation of beach (e.g. northeast-southwest record compass bearings)(use picture on next page) | |
| | Wind speed and direction (meters/second; direction wind is coming from, note bearing) | |
| | Direction waves are coming from (compass bearing) | |
| | Note status of tide on celestial menu on GPS (incoming or outgoing) | |

## *Gulf Shoreline* *Reference Chart: Orientation& Slope*




Write Distance from water to sand in blanks above, then plot #'s on graph

## *Gulf Shoreline* **Assessment**

1. According to your observations, which end of the island will the tennis balls end up if left alone?

2. How might this relate to the transport of sand and growth of the island?

3. If wave size is dependent on the distance the wind can travel over the water, which side of the island is likely to have the largest waves (Bay or Gulf)?

4. Why are small grains of sand found in the area where water is moving slowly and large grains and particles found where waves are breaking with lots of movement?

5. Look at the data for the surfers. Do you think that the slope of the beach has anything to do with the type of wave break? Describe why or why not.

## Portfolio Journal Prompt

Many people are attracted to Florida's beaches. Before you begin writing think about your favorite features of the beach. Think about the attractions the beach has for other residence and visitors to Florida. Describe what you think is the biggest attraction of the beach.

## *Gulf Shoreline* *Reference Chart: Breaker Types*

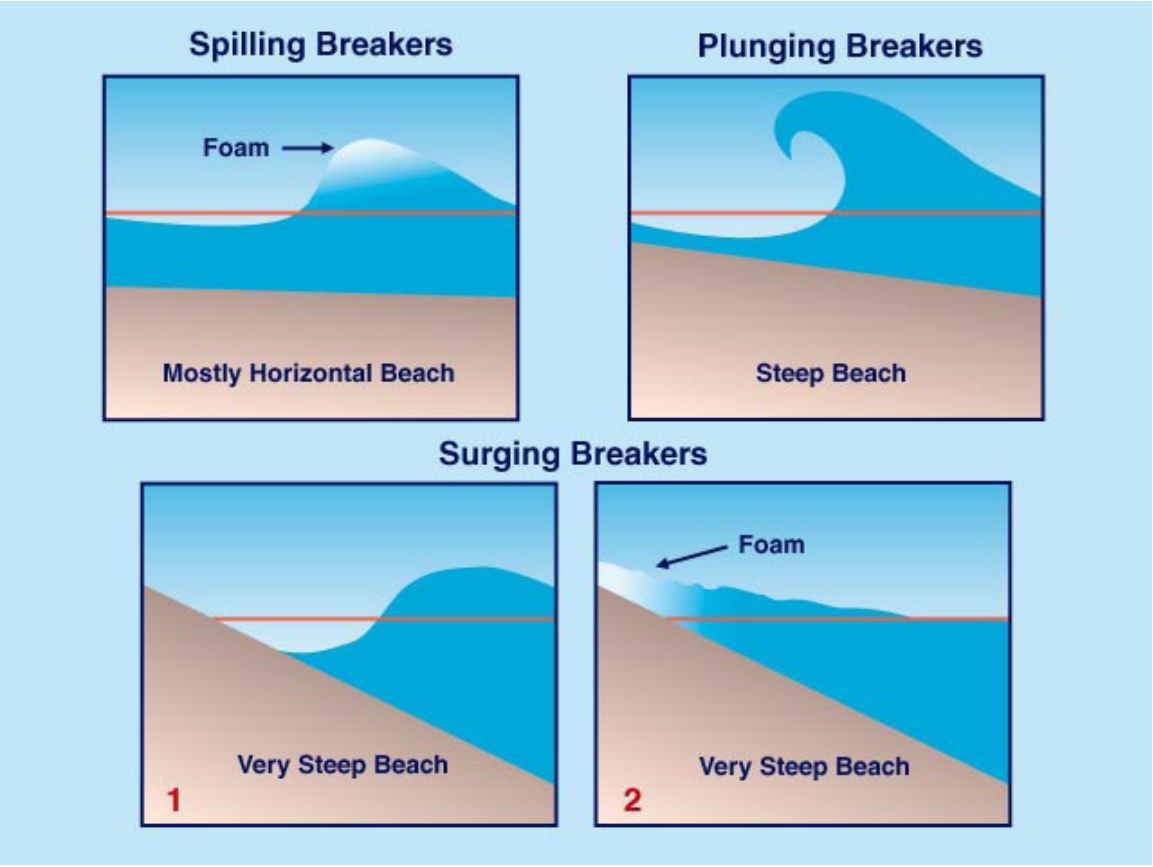



Figure 3. **Breakers.** The types of breakers in any surf zone are related to the profile--or steepness-- of the beach. A common type is the spilling breaker that results from a relatively gentle bottom slope. These have a relatively long life span but give surfers a less exciting ride than plunging breakers. Plunging breakers have a curling crest that moves over an air pocket. They form on moderately steep beach slopes. Surging breakers form on very steep beaches.