Gulf Shoreline Teacher's Guide

Subject (Body of Knowledge): Integrated Science (Life; Earth-Space; Physical)

Big Idea (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 (Pre-field Classroom Activity):

- **Vocabulary**: Wave, energy, shoreline, kinetic, erosion, frequency, slope, Longshore Current, Longshore Drift
- **Reference Material**: Motion in waves: http://www.geocities.com/CapeCanaveral/7639/oceans/wavid.htm
  National Geographic Wave Simulator: http://www.nationalgeographic.com/volvooceanrace/interactives/waves/index.html
  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

Procedure (Engage; Explore; Explain):

1. **Engage**. Have students speculate and discuss how waves form and what happens when they reach the shoreline.
2. **Explore**.
   a. Describe and demonstrate the use of equipment, and the proper units for each measurement for each group.
   b. Break students into three groups (surfers, beachcombers, and lifeguard), explain procedures, determine orientation of beach, identify where to collect sand, and mark locations for longshore drift and beach slope.
      - ***Surfers*** use measuring rod and stopwatch to record wave height and frequency (average 3 sets of waves/minute). Measure the slope of the beach (place stake at highest point the waves reach on shore and run a 6 meter line from the base of the stake to measuring rod in the water). Use a level to ensure the line is horizontal and record height on measuring rod. Note breaker type using reference chart.
      - ***Beachcombers*** use field microscope and sand gauge to compare sand grain size at different locations near the shore. Place two pinches of wet sand (from highest point reached by waves on shore and where waves are breaking) on either side of a Petri dish and compare under a field microscope (what differences are visible?). Measure the direction and speed of longshore drift (track movement of tennis balls placed where the waves are breaking for 5 minutes). Measure and record the average distance traveled by each ball using a stake and measuring tape. If ball washes ashore before 5 minutes, gently roll it back into the wave. Note the direction of longshore drift using compass bearings.
      - ***Lifeguards*** use 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. Monitor the work of the surfers (blow safety whistle if any potential hazards/emergencies are noticed)
   c. After all groups have completed their measurements, they re-group and share their data.
3. **Explain**.
   a. Answer and discuss the assessment questions as a group and allow each student to record an answer.
   b. Review the key concepts (vocabulary and items on pre/post-test).

Sunshine State Standards

Science: SC.6.E.6.1; **Mathematics**: MA.8.A.1.2; **Language Arts**: LA.7.1.6.1; **Social Studies**: SS.7.G.6.1

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 . . . _____

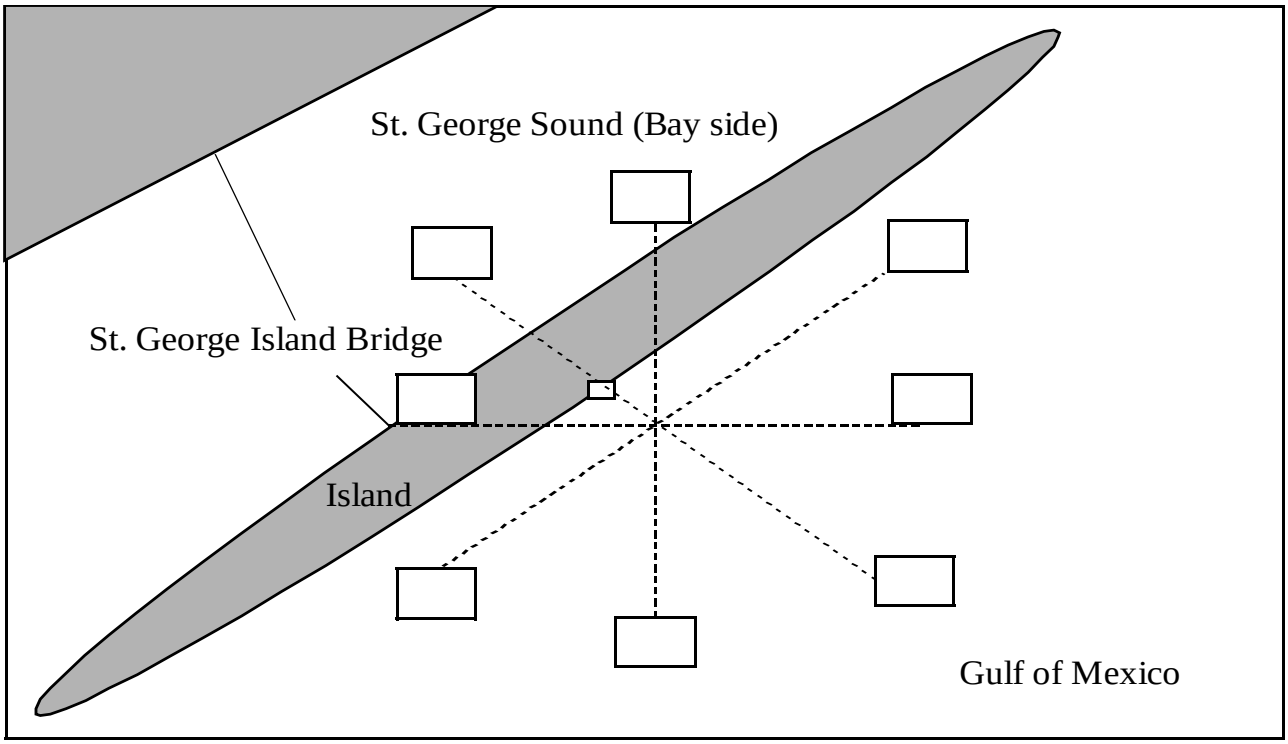
_____

_____.

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)	
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) 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***



Gulf Shoreline **Assessment**

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

2. How might the movement of the tennis balls 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*

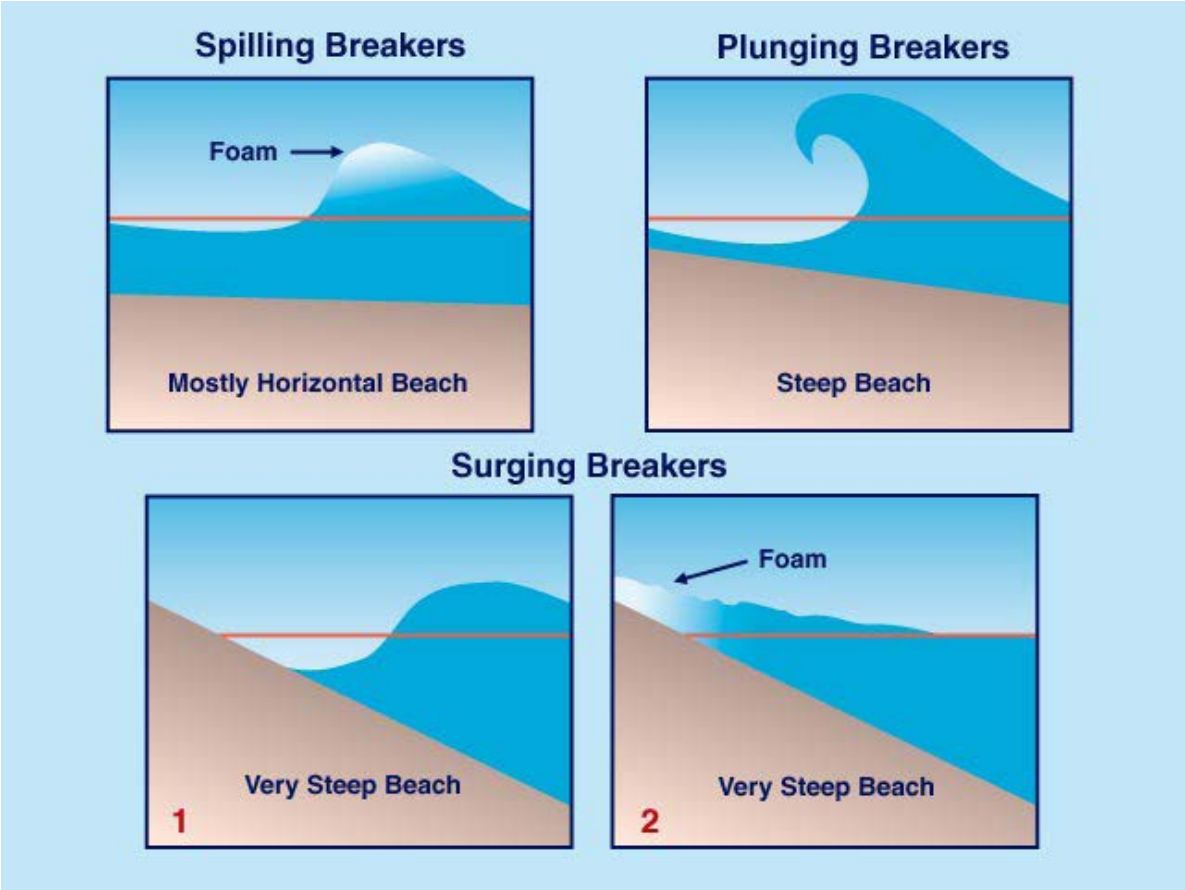


Figure 3. **Breakers.** The types of breakers in any surf zone are related to the profile--or steepness-- of the beach. A common type is the spilling breaker that results from a relatively gentle bottom slope. These have a relatively long life span but give surfers a less exciting ride than plunging 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.